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ABSTRACT

This book describes study and research programs and facilities at the Smithsonian Institution in 9 academic areas: 1) History of Science and Technology; 2) American Studies; 3) Cultural Studies; 4) Museum Studies; 5) Anthropology; 6) Evolutionary and Systematic Biology; 7) Environmental Biology; 8) Evolutionary and Behavioral Biology, Tropical Zones; and 9) Physical Sciences. Research programs are offered in most of these areas, but an investigator may be appointed Visiting Scholar or Visiting Scientist to pursue research independently. The principal facilities are located in Washington, D.C. and Cambridge, Massachusetts and include museums, galleries, libraries, archives, and specialized centers. Programs at the Office of International Activities and the Woodrow Wilson International Center for Scholars are also described. Financial assistance is available for most types of study and research. Biographies of the professional staff, their research interests, and activities are listed under the appropriate academic area. Copies are available from Office of Academic Programs, 236 Pension Bldg., Smithsonian Institution, Washington, D.C. 20560. (DS)

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smithsonian institution

OPPORTUNITIES FOR RESEARCH AND ADVANCED STUDY

Programs of Higher Education and Research Training in:

- HISTORY OF SCIENCE AND TECHNOLOGY
- AMERICAN STUDIES
- CULTURAL STUDIES
- MUSEUM STUDIES
- ANTHROPOLOGY
- EVOLUTIONARY AND SYSTEMATIC BIOLOGY
- ENVIRONMENTAL BIOLOGY
- EVOLUTIONARY AND BEHAVIORAL BIOLOGY, TROPICAL ZONES
- PHYSICAL SCIENCES

Fellowship Awards • Appointments Opportunities • Seminars with Tutorials Reference Resources • Biographies of Research Staff

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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OFFICE OF ACADEMIC PROGRAMS SMITHSONIAN INSTITUTION WASHINGTON, D.C. 1969

1970-1971

HOW TO USE THIS BOOK

Smithsonian study and research facilities are described under nine categorical headings reflecting academic disciplines. Listings for individual museums may be divided among different categories. Some units may appear under several categories and to some extent the academic disciplines overlap.

Professional staff members, along with their biographical data, are listed in accordance with their research interests and activities under the appropriate educational program. Thus some staff members' listings will appear more than once. Staff listings are intended to provide assistance to applicants in determining areas of research which can be undertaken at the Institution.

ED034485

contents

Page

Academic Appointments . . . iii
Short Term Visits . . . v
Introduction . . . vii
Programs in Education and Research . . . ix
  Office of International Activities . . . xiii
  Woodrow Wilson International Center for Scholars . . . xv

HISTORY OF SCIENCE AND TECHNOLOGY . . . 3

  National Museum of History and Technology . . . 4
  National Air and Space Museum . . . 18
  National Armed Forces Museum Advisory Board . . . 21
  Joseph Henry Papers . . . 24
  Archives . . . 25

AMERICAN STUDIES . . . 31

  American Studies Program . . . 31
  National Museum of History and Technology . . . 33
  National Portrait Gallery . . . 46

CULTURAL STUDIES . . . 53

  National Collection of Fine Arts . . . 53
  Cooper-Hewitt Museum of Design . . . 58
  Freer Gallery of Art . . . 60
  Joseph H. Hirshhorn Museum and Sculpture Garden . . . 62

MUSEUM STUDIES . . . 71

  United States National Museum . . . 73
  Smithsonian Institution Libraries . . . 76
  Information Systems Division . . . 79
  Science Information Exchange . . . 84

ANTHROPOLOGY . . . 93

  Department of Anthropology and the Center for the Study of Man . . . 94

Page

EVOLUTIONARY AND SYSTEMATIC BIOLOGY 105

National Museum of Natural History 106
  Office of Systematics 106
  Department of Botany 108
  Department of Entomology 117
  Department of Invertebrate Zoology 127
  Department of Paleobiology 137
  Department of Vertebrate Zoology 146

ENVIRONMENTAL BIOLOGY 161

Office of Ecology 162
Radiation Biology Laboratory 165
National Zoological Park 172
Office of Oceanography and Limnology 177
  Smithsonian Oceanographic Sorting Center 180

EVOLUTIONARY AND BEHAVIORAL BIOLOGY, TROPICAL ZONES . 189

Smithsonian Tropical Research Institute 190

PHYSICAL SCIENCES 197

Smithsonian Astrophysical Observatory 197
Department of Mineral Sciences, National Museum of Natural History . 222

ALPHABETICAL INDEX OF SMITHSONIAN STAFF 227

ACADEMIC APPOINTMENTS

Visiting Senior Investigators

The Institution encourages the fullest practical use of its facilities and reference resources by visiting scholars, who may be appointed Visiting Scholars or Visiting Scientists following consultation with any member of the professional research staff listed herein.

Programs in Higher Education and Research Training

Appointments as *Visiting Postdoctoral Research Associates* are available to scholars or scientists possessing the Ph. D., or the equivalent, who wish to continue postdoctoral studies and conduct research in collaboration with a member of the professional research staff of the Institution. A limited number of stipends of $9,500 per annum, supplemented by allowances for research expenses, dependents, and travel, will be offered on a competitive basis. Stipend awards are limited to those candidates having received their Ph. D. or equivalent degree within five years of commencing tenure at the Institution. The Institution awards its Certificate of Academic Accomplishment for the completion of research assignments under this and the following programs. Appointments as *Visiting Research Associates* are available to students upon recommendation by the university where they have substantially completed formal course requirements for the doctorate or equivalent degree, to conduct research, the satisfactory completion of which is expected to result in the award of that degree. Projects must be approved in advance by a Smithsonian staff member who will serve as the *Associate's* advisor. A limited number of stipends of $3,000 for a twelve-month period, plus allowances for research expenses, travel, and dependents, will be offered on a competitive basis. Six months is the minimum period for appointments carrying stipends, and for such appointments two months' residence at a Smithsonian facility is the minimum. In all cases the full tenure of appointments will be under the direct supervision of a member of the Institution's staff. Appointments are available only to students and scholars intending to pursue research assignments or projects which relate to Smithsonian research and interests of the professional staff. The Institution's capacity to offer appointments for more than twelve months is severely limited and renewal requests will be considered as new applications.

DEADLINE FOR COMPLETED APPLICATIONS
FOR THE *1970–1971* ACADEMIC YEAR: *2 January 1970.*

Cooperative Programs

Graduate students enrolled in seminars and tutorial studies at the Smithsonian for academic credit from their universities are eligible for financial assistance supplementing university or other fellowships where those are not sufficient to meet living expenses and fees. Such assistance generally takes the form of a *Cooperative Fellowship* offered under a cooperative agreement between the Smithsonian Office of Academic Programs and the university. Representatives of university departments and students are encouraged to contact the Office of Academic Programs concerning the possibilities for cooperative arrangements.

Undergraduate Research Participation, 1970

Undergraduate students may apply for appointments of ten to twelve weeks' duration. Students should be studying subject areas listed herein or be able to offer evidence of serious interest in them. Undergraduates in the classes of 1970, 1971, and 1972 are eligible for appointment. Following submission by students, applications and project descriptions will be submitted to cognizant members of the Smithsonian professional staff, whose approval is required for all appointments. A limited number of stipends is expected to be available in all nine educational program areas, although support in the arts and humanities cannot be guaranteed at the present time. Stipends are fixed at $60 per week plus travel and research-related expenses.

DEADLINE FOR COMPLETED APPLICATIONS
FOR THE SUMMER OF 1970: 1 February 1970.

Graduate Research Participation, 1970

It is hoped that the Institution will be able to offer a small number of stipends for research participation in the summer of 1970, similar to undergraduate research program described above. Such awards would carry stipends of $80 per week, plus travel and research-related expenses. DEADLINE FOR COMPLETED APPLICATIONS FOR THE SUMMER OF 1970: 1, February 1970.

Work-Study Programs

A limited number of appointments may be made for purposes of on-the-job training in fields related to museums and museum occupations, in a program conducted jointly with the United States National Museum.

Technical Education

The Institution is keenly interested in developing programs of technical education and technician training. Inquiries are welcome and may be addressed to the Division of Graduate Studies, Office of Academic Programs.

SHORT-TERM VISITS

Financial support to a very limited extent is available for students and scholars wishing to utilize the facilities of the institution on a short-term basis. Inquiries may be directed to the Division of Graduate Studies or to the appropriate member of the research staff as listed in this publication.

* * * *

Applicants are invited to correspond directly with the Smithsonian Astrophysical Observatory, 60 Garden Street, Cambridge, Massachusetts 02138, about visiting research appointments in astrophysics, geodesy, meteoritics, and space sciences, some of which are offered in conjunction with the Office of Scientific Personnel, National Research Council, 2100 Pennsylvania Avenue, N. W., Washington, D. C. 20418. The Observatory will consider applications submitted at any time of year.

In selecting individuals for participation in academic programs the Smithsonian Institution does not discriminate on grounds of race, creed, color, or national origin of any applicant. Candidates are evaluated on their academic standing, scholarly competence, and the suitability of the research proposed to Smithsonian facilities and programs.

INTRODUCTION

The Smithsonian Institution is an establishment devoted to basic research, public education, and national service in science, the humanities, and the arts. Its facilities for research are extensive and its collections constitute a unique resource for research in a number of disciplines, scientific and humanistic. The research staff of over 300 professional scholars and scientists includes many specialists who may undertake research in cooperation with visitors or graduate students requiring supervision. Over the past century, hundreds of guest research scholars, collaborators, and associates have successfully completed significant projects, establishing a tradition for the Institution. Their work may be viewed collectively as a leading contribution to our intellectual heritage.

In the years since its establishment in 1846 the Smithsonian Institution has undertaken many research efforts through its own staff and facilities. It has not developed into a granting agency or a government department with applied or service tasks. Its museums and laboratories have become national institutions, operating in part under the government but within the primary jurisdiction of the Board of Regents of the Smithsonian and under the direction of its Secretary. The original authorization of the Smithsonian and its subsequent history have given rise to Institution commitments to continuing study in broad fields of science and learning.

Smithsonian scholars and scientists may provide graduate and undergraduate level instruction and guidance in research, while enjoying freedom from heavy schedules of course work and teaching. The location of principal research facilities in Washington, D.C., and in Cambridge, Massachusetts, permits a wide range of associations with kindred workers in leading university and national laboratories, while the Institution's independent character reserves to each investigator a somewhat greater then average degree of choice in such matters. The excellence, and often the uniqueness, of its facilities also contributes to the research environment.

Recognizing the severe shortage of trained scientists and scholars in many fields for which the Smithsonian feels a special responsibility, the Institution provides financial support in the form of fellowships to students and other qualified investigators. Its staff members, many with academic backgrounds, teach courses at nearby or cooperating institutions, conduct seminars, and act as research supervisors for postdoctoral associates or students who are preparing dissertations for doctoral degrees from their own universities. The staff members listed herein, facilities, and collections of the Smithsonian complement those of universities and educational institutions, and are the essential basis for the Institution's service as a national center of research training.

The Smithsonian Institution Press is resourceful in assistance and can provide direct publication in Smithsonian series of worldwide prominence. The

Smithsonian Institution Libraries, Information Systems Division, Science Information Exchange, and other information and reference facilities are at the disposal of students and qualified investigators.

The Smithsonian also provides opportunities for training and employment-related occupational experience for museum careers and technician occupations. Inquiries about work-study programs should be addressed to the Office of Academic Programs.

The most distinctive quality of Smithsonian research arises from participation in a common enterprise which fosters a cooperative spirit and frequent consultation, without undue supervision or any sacrifice of individual independence to superimposed objectives. The cooperative work and interdisciplinary effort that have been customary in Smithsonian research arise from the individual investigator's perception of common objectives within the framework of a single institution. They will continue to be, as they have been, a matter for individual choice in response to opportunity.

PROGRAMS IN EDUCATION AND RESEARCH

This booklet describes programs through which the Smithsonian provides opportunities to students and other investigators who desire training or consultation with colleagues whereby they may further their ability to undertake fully independent study. The Smithsonian considers applications from qualified individuals without regard to their specific institutional affiliation or nation of origin. But in addition to arrangements with individual investigators the Smithsonian is prepared to enter into continuing cooperative agreements which may in their simplest forms provide for exchange of publications or other information, and also more elaborate cooperative undertakings with universities, museums, and other research institutions. These may provide for exchanges of staff, regular or honorary faculty appointments for Smithsonian members, joint undertakings in research, or the establishment of consortia of institutions. The Smithsonian now has cooperative agreements in many different forms with over forty universities. Primary responsibility for university relations and cooperation with academic institutions is vested in the Smithsonian's Office of Academic Programs, listed at the end of the following list of the program officers of the Institution. Correspondents of the Institution are invited to write to any of the program officers listed below, as well as to bureau directors and other officers listed in this booklet.

SECRETARY OF THE SMITHSONIAN INSTITUTION: S. Dillon Ripley. 1936: B.A., Yale; 1943: Ph. D., Harvard; 1961: M.A. (hon.), Yale; 1965: D. H. L. (hon)., Marlboro; 1966: D.Sc. (hon.) George Washington; 1967: L.L.D. (hon.), Dickinson; 1968: L.L.D. (hon.), Hofstra; 1942: Assistant Curator of Birds, Smithsonian; 1946–1963: Associate Curator and Curator of Vertebrate Zoology, Peabody Museum, Yale University; 1946–1961: Assistant and Associate Professor of Zoology, Yale University; 1961–1964: Professor of Biology, Yale University. Faculty Titles: Research Affiliate, Ornithology, Peabody Museum, Yale; Curator, William Robertson Coe Collection Ornithology, Yale University Library. Speciality: ecological principles, especially as exemplified in birds of the Old World tropical zones; current research on *Handbook of Indian Birds* (with Salim Ali) and *Rails of the World.* Fieldwork: India, Nepal, Assam, Indonesia, Bhutan. Books: *A Synopsis of the Birds of India and Pakistan,* Bombay Nat. Hist. Soc. (1961); *A Systematic and Ecological Study of the Birds of New Guinea,* Peabody Mus. Nat. Hist., Yale, Bul. 19 (1964); *The Sacred Grove: Essays on Museums* (1969). Articles: "The Families Prunellidae and Muscicapidae" in *Checklist of Birds of the World* (1964); "Le Martinet pale de Socotra *L'Oiseau* (1965); with Gerd H. Heinrich, "Additions to the Avifauna of Northern Angola II," *Postilla* (1966); "A Notable Owlet from Kenya," *Ibis* (1966); with Gorman M. Bond, "The Birds of Socotra and Abd-El-Kuri," *Sm. Misc. Coll.* (1966). Speaks French, Indonesian.

Assistant Secretary of the Smithsonian Institution: James Christopher Bradley, Jr. 1931: B.S., Catholic University of America; 1931–1935: Practice in general engineering and construction; 1935–1945: Engineer, Administrator D. C. Government; 1945–1950: Budget analyst, United States Bureau of the Budget; 1950–1959: Administrative Assistant to the

Assistant Secretary, Principal assistant to the Under Secretary, Department of the Interior; 1950–1959: Assistant to the Secretary, Smithsonian Institution.

Treasurer of the Smithsonian Institution: Towson Ames Wheeler. 1932: A. B., Harvard; 1943: M.S., Harvard; 1934–1935: Engineer, Chrysler Corporation; 1935–1938: Analyst, Investment Counsel Incorporated, Detroit; 1939–1942: Investment staff, The Detroit Bank; 1942–1946: Treasury staff of the United States Steel Corporation of Delaware, Pittsburgh; 1946–1949: Statistician, Allegheny Ludlum Steel Corporation; 1949–1960: Controller; 1960–1963: Vice President in Charge of Planning; 1963–1966: Vice President, international and affiliated operations; 1967–1968: Vice President, Secretary; 1968: Treasurer of the Smithsonian Institution.

NATURAL SCIENCES AND ANTHROPOLOGY: Sidney R. Galler, Assistant Secretary for Science. 1944: B.S., Maryland; 1947: M.S., Maryland; 1948: Ph.D., Maryland; 1942–1943: Assistant, Agricultural Experiment Station, University of Maryland; 1944–1946: Fellow, University of Maryland; 1946–1948: Assistant Zoologist, University of Maryland; 1947: Collaborator, U.S. Fish and Wildlife Service; 1948–1950: Consultant in Human Ecology and Biophysics, and Acting Head, Biophysics Branch, Office of Naval Research; 1950–1951: Head, Ecology Section, Biology Branch, Office of Naval Research. Specialties: chemical, physical, and biological investigations of acid ponds; polluted streams; development of microtechniques for cytological studies of marine organisms, temperature-controlled test panels for ecological investigations of aquatic invertebrates, biotelemetry for migratory studies of animals, research administration. Articles: "Comments on Specifications for a Desirable Shark Repellent" in *Sharks and Survival*, ed. P. W. Gilbert (1963); "Marine Biology" in *Ocean Sciences*, ed. E. J. Long (1964); "Perspectives in Animal Telemetry" in *Biomedical Telemetry*, ed. C. A. Caceres (1965); "The Bridge between 'Useless' Research and Applied Information," *Marine BioAcoustics* (1967); "Hydrobiological Aspects of Ocean Engineering," *The Ocean Engineering Handbook* (1969).

ANTHROPOLOGY: Sol Tax, Special Advisor in Anthropology to the Secretary; Acting Director, Center for the Study of Man; Professor of Anthropology, University of Chicago. 1931. Ph.B., Wisconsin; 1953: Ph.D., Chicago; 1955–1958: Chairman, Department of Anthropology, University of Chicago; 1962–1963: Chairman, Division of Social Sciences, University of Chicago. Specialties: social anthropological theory, Middle American ethnology, action anthropology; current research on North American Indians, particularly Guatemalans. Fieldwork: Guatemala, Mexico. Books: *Heritage of Conquest: The Ethnology of Middle America* (1952); *Penny Capitalism: A Guatemalan Indian Economy* (1953); ed., *Horizons of Anthropology* (1964); *Practical Animism: A Guatemalan Indian World View* (1967). Speaks Spanish.

HISTORY AND ART: Charles Blitzer, Assistant Secretary for History and Art. 1948: B.A., Williams; 1950: M.A., Harvard; 1952: Ph.D., Harvard; 1951–1960: Instructor and Assistant Professor of Political Science, Yale; 1962: Lecturer, New School for Social Research; 1964–1965: Visiting Professor, City University of New York. Specialties, history of political thought, 17th-century history. Books: with Carl J. Friedrich, *The Age of Power* (1957); *An Immortal Commonwealth* (1959); *The Age of Kings* (1967).

EXTERNAL AFFAIRS: William W. Warner, Assistant Secretary for Public Service. 1943: B.A., Princeton; 1947: Columbia Teachers College; 1951–1953: Director of Courses, Instituto Chileno-Norteamericano de Cultura, Santiago, Chile; 1954–1956: Cultural Affairs Officer, U.S. Embassy, Guatemala; 1956–1958: Public Affairs Officer, U.S. Embassy, San Jose, Costa Rica; 1960–1961: Chief, Book Development Program, Information Center Services, USIA; 1961–1962: Area Coordinator for Latin America, Peace Corps; 1962–1963: Executive Secretary, Peace Corps; 1964–1968: Director, Office of International Activities, Smithsonian. Specialties: colonial history of Central America; international cultural and educational affairs, and administration thereof. Currently working on coordination of Smithsonian resources involved in its public role. Articles "Puritans in the Tropics: Motives in the Settlement of Providence Island," *Proc. 33rd Intl. Cong. Americanists* (1960); "Travel Notes from Iceland," *Atlantic Naturalist* (1967); various articles in Spanish on American culture, in Latin American journals. Speaks Spanish.

MUSEUMS AND MUSEUM EDUCATION AND TRAINING: Frank A. Taylor, Director, United States National Museum. 1928: B.S., Massachusetts Institute of Technology; 1934: LL. B., Georgetown; 1928–1932: Assistant Curator, U.S. National Museum; 1931: Instructor in Mechanical Engineering, Catholic University of America; 1932–1948: Curator, Division of Engineering, U.S. National Museum; 1948–1955: Head Curator, Department of Engineering and Industries, U.S. National Museum; 1955–1958: Assistant Director, U.S. National Museum; 1958–1964: Director, Museum of History and Technology, U.S. National Museum. Specialty: museum administration, and consulting work in that field. Fieldwork: industrial museums in Europe. Articles: sections in *Dictionary of American Biography* (1928); "Catalog of the Mechanical Collections of the Division of Engineering," *USNM Bul. 173* (1939); also technical articles on history of technology, biography, museum planning.

See also Office of the Director, U.S. National Museum.

INTERNATIONAL ACTIVITIES: David Challinor, Director, Office of International Activities, 1943: B.A,, Harvard; 1946: Harvard Law School; 1959: M.F., Yale Forestry School; 1966: Ph.D., Yale; 1947–1951: cotton merchandizing and crop financing with Anderson, Clayton, and Co., Houston; 1951–1953: cotton farmer in Culberson County, Tex.; 1953–1957: various positions and Assistant Secretary, First Mortgage Co, of Houston; 1957–1959: associated with Department of Soils and Climatology, Connecticut Agriculture Experiment Station; 1960–1966: Deputy Director and Acting Director, Peabody Museum of Natural History, Yale; 1966–1967: Special Assistant in Tropical Biology, Smithsonian. Specialties: forest soils, international efforts in conservation and environmental studies. Book: *Alteration of Surface Characteristics by Four Tree species* (1966).

See also Office of International Activities.

ACADEMIC PROGRAMS: Philip C. Ritterbush, Director, Office of Academic Programs. 1958: B.A., Yale; 1961: D.Phil., Oxford; 1966: M.A., Oxford; 1962: Technical Assistant, Office of the Special Assistant for Science and Technology, White House; 1962–1963: Lecturer in the History of Science and Medicine, Yale University; 1962–1964: Legislative Assistant, U.S. Senate; 1964–1968: Staff Assistant to the Secretary, Smithsonian. Current studies in cultural relations of science, institutional systems in higher education and research. Books: *Overtures to Biology* (1964); *The Art of Organic Forms* (1968). Articles: "Research Training in Governmental Laboratories in the United States," *Minerva* (1966); "Biology and the Smithsonian Institution," *Bioscience* (1967); "Environment and Historical Paradox," *General Systems* (1968); "The Educated Man in the year 2000," *Vital Speechs* (1969).

Program in Elementary and Secondry Education: Nathaniel R. Dixon, Associate Director, Office of Academic Programs. 1940: B.S., Miner Teachers College; 1957: M.A., George Washington; 1940–1958: Teacher, D.C. Board of Education; 1958–1968: Elementary School Principal, D.C. Board of Education; 1950–1953: Instructor and Supervisor, National Institute of Painting and Decorating. Specialty: elementary education, particularly administration and audiovisual aids.

Programs in Higher Education and Research Training, and Work-Study and Technical Education: Peter H. Wood, Assistant Director, Office of Academic Programs. 1953: B.A., Haverford; 1964–1968: Ecole Pratique des Haute Etudes, Paris; 1956: Secretary, Arctic Committee, U.S. National Committee for the I.G.Y., National Academy of Sciences; 1958: Executive Officer, Arctic Institute of North America. Specialties: characteristics of institutions of higher education and research; geography. Book: *Arctic Research in Western Europe* (1968): Speaks French.

Seminars and Conferences: Wilton S. Dillon, Director of Seminars, Office of Academic Programs. B.A., University of California at Berkeley; 1951–52: Graduate study, Institute of Ethnology, University of Paris and University of Leyden; 1961: Ph.D., Columbia; 1946–1949: Information Specialist, U.S. Government, Tokyo; 1952–54: Visiting Lecturer in Sociology and Anthropology, Hobart and William Smith Colleges; 1954: Staff Anthropologist, Japan Society of New York; 1954–56: Director, Clearinghouse for Research in Human Organization, Society for Applied Anthropology; 1957–63: Executive Secretary and Director of Research, Phelps-Stokes Fund of New York; 1963–69: Head of African Affairs Section, and Staff Director of Science Organization Development Board, National Academy of Sciences. Specialities: Sociology of knowledge, cross-cultural communications, gift behavior, evolution of institutions of science and technology in new societies. Fieldwork: France, Ghana, Togo. Book: *Gifts and Nations* (1968). Articles: "Universities and Nation-Building," *Journal of Modern African Studies* (1963); "Wandering African Intellectuals," *New Republic* (1963); "New Frontier Tribesmen," *Columbia University Forum* (1963); "The Flow of Ideas Between Africa and America," *Bulletin of the Atomic Scientists* (1966); "Nigeria's Two Revolutions," *Africa Report* (1966); "Science in Africa," *Encyclopedia Americana* (1968). Speaks French.

OFFICE OF INTERNATIONAL ACTIVITIES

DAVID CHALLINOR, *Director*

KENNEDY B. SCHMERTZ, *Special Foreign Currency Program*

The Office of International Activities seeks to establish cooperative research programs with institutions of higher learning in other countries and to foster international exchange of persons' programs in the sciences and humanities of traditional concern to the Institution. The Office administers the Smithsonian's special foreign currency program and the joint Smithsonian-Organization of American States fellowship program for Latin American graduate students in the biological sciences; it also provides advisory services to the Departments of State and various private organizations on exchange of persons in fields of Smithsonian competence.

Special Foreign Currency Program

In 1965 the Smithsonian Institution inaugurated a program of foreign currency support for American institutions of higher learning in the so-called "Public Law 480 excess countries." These are nations in which the United States government holds amounts of foreign currencies, derived from the sale of surplus agricultural commodities, which the Treasury Department had determined to be in excess of the normal requirements of the United States.

Under this program American universities or museums may apply to the Smithsonian for foreign currency grants to cover the costs of field expeditions or research in the excess currency countries. At the present time, these countries are Burma, Ceylon, Egypt, Guinea, India, Israel, Pakistan, Poland, Tunisia, and Yugoslavia.

During its first years, the program concentrated its grant awards on archeological excavations and research. For the subsequent fiscal years, as a result of broader program authority and an annual appropriation equivalent to $2,316,000 (U.S.) in foreign currencies, the Institution will consider grant proposals in the anthropological sciences in general and in systematic and environmental biology. In the anthropological sciences the Smithsonian is especially interested in using its grant resources for projects in those excess-currency countries where little or no archeological or ethnological investigations have been carried out by American institutions. In the biological sciences the Institution will especially welcome project proposals which can contribute to the objectives of the International Biological Program.

Interested institutions may wish to consider the following general guidelines for the preparation of proposals:

1. The Smithsonian cannot consider proposals for work in countries other than those which the Treasury Department has determined to be in the excess-currency category, as listed above. This determination is under continuing review; consequently, countries are added to or dropped from the excess-currency list from time to time. Once the Institution awards a foreign currency grant, however, it is available until expended and is not affected by any subsequent changes in the excess-currency status of a given country.

2. Grants can be made only to American institutions, but this does not preclude the possibility of making cooperative arrangements with host country institutions or the hiring of foreign nationals. On the contrary, the Smithsonian believes that wherever possible grantee institutions should seek maximum support or cooperation from appropriate host country organizations, governmental or private.

3. The Smithsonian will normally expect interested American universities and museums themselves to bear the U.S. dollar costs of preliminary explorations abroad or preparatory studies in the United States and that information on these prior expenditures will form part of their proposals. The Smithsonian, therefore, will not consider proposals aimed at exploring the potential of a given site or carrying out preliminary reconnaissance of promising areas.

4. The main purpose of the Smithsonian's program is to extend support for field work abroad; that is. to provide local currencies for those expenditures that can most advantageously be met overseas. Typical expenditure items might include salaries to associate investigators, foremen, draftsmen, or laborers; costs of field equipment and supplies that can best be obtained abroad; construction costs for temporary buildings or shelters; in-country travel; and international travel to and from countries that permit the purchase of air transportation in their own currencies rather than in U.S. dollars.

5. In most cases the Smithsonian will prefer to award annual grants, subject to yearly review and renewal. Institutions with project proposals having a clearly predictable termination may, however, submit proposals for two, three, or more years. Application is made to the Foreign Currency Program, Office of International Activities, Smithsonian Institution, Washington, D.C. 20560.

International Exchange of Persons

The Office of International Activities welcomes inquiries, whether from foreign scholars coming to the United States or Americans going abroad, concerning research or training opportunities in the scientific and humanistic disciplines of interest to the Smithsonian and in museum technology and museum administration, By agreement with the Department of State the Office provides this kind of advisory service, including programming for foreign grantees during their visits to the United States, for the Department's and other federal exchange of persons' programs; but the Smithsonian is equally interested in extending similar service to individual scholars and to privately sponsored programs.

In encouraging exchanges of museum professionals, the Smithsonian works especially closely with the American Association of Museums. It is expected that in the future the Association and the Smithsonian will be able to offer increased opportunities for training and experimental research in the museum professions.

Joint Smithsonian-OAS Fellowship Program

In this program the Pan American Union's Fellowship Program provides grants, from three months to one year in duration, to Latin American graduate and postgraduate students interested in pursuing field studies in environmental biology at the Smithsonian Tropical Research Institute (formerly the Canal Zone Biological Area). For those primarily interested in taxonomic study collections, similar opportunities may be arranged at the Smithsonian's National Museum of Natural History. Inquiries should be sent to the Technical Secretary, OAS Fellowship Program, Pan American Union, Washington, D.C. 20006.

WOODROW WILSON INTERNATIONAL CENTER FOR SCHOLARS

BENJAMIN H. READ, *Acting Director*

The Woodrow Wilson International Center for Scholars was created by Act of Congress in October 1968. Its mandate is to be "a living institution expressing the ideals and concerns of Woodrow Wilson . . .symbolizing and strengthening the fruitful relation between the world of learning and the world of public affairs." The development of the substantive roll of the Center in carrying out this mandate is now in progress. The views of many distinguished citizens of the United States and the nations of the world have been invited to assist in planning the Center's direction. Members of the academic community at large, with an interest in the Center's future, also are invited to correspond with the Acting Director. Although Congress placed the Center in the Smithsonian Institution, it has an independent 15-man Board of Trustees under the Chairmanship of former Vice President Hubert H. Humphrey. In March 1969 the Board selected Benjamin H. Read as Acting Director, to develop and administer the Center during its formation. The Center is temporarily located in the Smithsonian Institution Building while the recommended site in the future, Market Square on Pennsylvania Avenue,is under study.

BENJAMIN H. READ, Acting Director, Woodrow Wilson International Center for Scholars. 1949: B.A., Williams College; 1952: L.L.B., University of Pennsylvania. 1952–1954: Associate, Duane, Morris & Duane, Philadelphia; 1955–1956: Assistant Defender, Voluntary Defender Association, Philadelphia; 1957–1958: Attorney, Legal Adviser's Office, Department of State; 1958–1963: Legislative Assistant to Senator Joseph S. Clark; 1963–1969: Executive Secretary of the Department of State and Special Assistant to the Secretary of State.

HISTORY OF SCIENCE AND TECHNOLOGY

INTRODUCTION

Efforts to understand and communicate the history of science and technology, representing a major effort and continuing objective on the part of a varied group of scholars within the Institution, have contributed to the universal recognition of this vital new discipline. In recent years these efforts have become more and more directed in a cooperative and informative mode toward an involvement with the academic community as well as the learned public. The superb collection of scientific instruments directly portrays such central aspects of science as measurement and experimental design. It documents the interrelation of social and technological change and the process of sophistication in the physical sciences, engineering, medicine, electronics, surface transportation, and flight vehicles. The collective efforts of twenty professionally qualified historians of science and technology have given rise to a capacity to support dissertation and other research in the furtherance of educational goals. A strong staff interest in teaching and an equally strong series of applications from students have combined to foster a program of formal instruction in this discipline. Ten members of the staff will cooperate with nine visiting scholars to conduct a series of nine graduate-level seminars representative of the research activity in this program area. In addition, tutorials are offered by the staff in twenty-seven other specified topics related to the history of science and technology. This kind of faculty-student involvement within the facilities of the Institution is made possible through the active role of the staff in assuming a teaching or instructional posture. By supervising and leading in-house student educational and research activities and also, for example, by sponsoring student conferences and field research in cooperation with universities and research and historical associations, the staff in this subject area is demonstrating a dynamic approach to teaching which is drawing substantial educational benefits from a comprehensive research competence.

In the field of History of Science and Technology it is expected that the Office of Academic Programs will be able to offer a total of 10 Visiting Research Appointments in its programs of higher education and research training of which full stipends may be awarded to two Visiting Postdoctoral Research Associates and two Visiting Research Associates (Ph.D. candidates).

In addition to the research staff listed below, other staff members with related interests will be found at the end of this section on History of Science and Technology.

NATIONAL MUSEUM OF HISTORY AND TECHNOLOGY

DANIEL J. BOORSTIN *Director*

Opened to the public in January 1964, the Smithsonian's National Museum of History and Technology is equipped to accommodate exhibition halls, work rooms, research collections, libraries, and laboratories. The research facilities are in full operation, and some two dozen of the exhibition halls are now open.

In this book the Museum is treated as part of two categories: American Studies and the History of Science and Technology. The emphasis of the collections is American, but many of them, especially those in science and technology, are worldwide in interest and content. The Museum's large collections provide opportunities for research in all aspects of American civil and military history and the history of science, technology, and arts and manumanufactures.

The museum historian does not limit his research to written source materials in reconstructing and interpreting history but seeks history in objects as well as in words. In field and laboratory he employs the tools and methods of modern technology to obtain a more precise understanding of how people lived in the past. He consults a greater variety of sources than does the academic historian. In the National Museum of History and Technology he finds an opportunity to read history not only in letters and documents but also in illustrated trade catalogs, magazine and newspaper advertisements, plans, drawings, paintings, prints, and photographs, and in three-dimensional objects. He can concern himself with the broader implications of objects—the roles they played in the cultures which produced them and the social implications of technological change.

Important collections of objects in each of the seventeen divisions of the Museum, supplemented with archival collections of significance, form the basic facilities for research in material American culture, as well as in all aspects of American history as related to world history and the general history of science and technology.

The most challenging opportunities exist to pursue studies in the historical conjunctions of science, technology, material culture, and the decorative arts. The Smithsonian offers these opportunities at the center of Government archives and research libraries and institutions. Its own archives comprise a noteworthy source of material for studies of nineteenth-century relations of science and government.

Library

The library of the Museum is a research library with collections in cultural and military history, history of science and technology, history of manufactures, and history of the graphic arts. The trade literature collection (more than 225,000 volumes) provides invaluable material for the study of economic history, modern technology, and the history of manufactures. Other special collections include the George H. Clark Collection on the history of radio and allied industries. The philatelic collection is perhaps the largest on philately and postal history to be found in the United States.

The National Museum of History and Technology is one of the foremost research institutions for the study of the American past and its relation to the present, as is demonstrated in the descriptions of its collections and programs.

COLLECTIONS AND RESEARCH SPECIALTIES

MATHEMATICS

A collection in mathematics is concerned with the history of mathematical instruments and machines. Research in this area covers the technological and mathematical aspects of the objects under study, as well as problems related to the role of the object in society during a given period of time.

Primary research emphasis is placed on the nineteenth and twentieth centuries, reflecting the strength of the collections on hand. Subjects of study for this period include adding and calculating machines, modern computers, cash registers, tabulators, slide rules, planimeters and other simple integrators, harmonic and differential analyzers, as well as ruling and dividing engines.

Research in the earlier history of mathematical instruments covers such topics as simple counting and calculating aids, astrolabes and gnomonic instruments, calendrical computing devices, and miscellaneous mathematical scales, including sectors.

A fellowship in computer history is available each year in the section of mathematics through the sponsorship of the American Federation of Information Processing Societies. The fellowship is open to all qualified scholars and to graduate students with the concurrence of their university departments. Appointments generally will be made for a minimum of six months. The stipend will depend upon the applicant's qualifications, educational background, and experience. For further information and application forms write to the principal investigator of the Computer History Project, Dr. Uta Merzbach.

SCIENCE AND TECHNOLOGY

The extensive collections in science and technology are largely concerned with the history of mechanical, civil, electrical, and chemical engineering;

astronomy, physics, chemistry, electricity, geodesy, and meteorology; medicine and pharmacy; and land and marine transportation. In each of these fields a collection of historic objects and objects representative of stages in technical development is maintained.

Collections

The receipt of a large collection often poses a problem in cataloging and documentation. Such collections sometimes come to the Museum because their processing has been beyond the capacity of other museums or private collectors. The extant records may be incomplete, and their rehabilitation and full documentation may require years. The extensive collections in these fields including some 85,000 objects and many blueprints, plans, and documents, form the basis not only for organization and exhibition by curators but also for research and the writing of history by staff members and visiting specialists, such as the recent publications on scientific instruments, bark canoes and skin boats, Islamic medicine and pharmacy, early automobiles, early engineering, locomotive building, the origin of chemistry, clocks, screw-thread cutting, steamships, early electromagnetic instruments, bridge building, and other aspects of the history of science and technology.

The objects held in the collections of science and technology are spread throughout virtually the full range of the physical sciences, technology, and medicine. Some collections of particular interest are the following:

Physical Sciences

Instruments related to meteorology, hydrography, geodesy, and surveying in the nineteenth century.

Instruments used in the teaching of physics in the nineteenth century.

A collection of chemical apparatus used by the eightteenth-century chemist Joseph Priestley after he moved to America, as well as chemical glassware of the nineteenth and twentieth centuries.

Electricity

Instruments related to telegraphy, telephone, and radio.

Motors and generators to 1900.

Electric meters to 1900.

The Clark Radio Collection, consisting of manuscripts, clippings, photographs, patents, etc.

Rare books and official reports, as well as drawings, photographs, and fine prints, a considerable portion of which is as yet unclassified.

Hammer Collection: documents collected by W. J. Hammer, an associate of Edison, related to electric power and other electrical topics at the end of the nineteenth century.

Transportation

Rich collection of ship plans concentrating on the evolution of American merchant ship types and specialized craft, sail and power, from 1650 onward, including representational plans of vessels from European archives. Some 200 half or builders models; a small but excellent working library, 500-volume Cropley collection of clippings pertaining to ships and shipping; an extensive photographic file and much supporting material concerning the maritime history of the United States. The transportation exhibit hall contains one of the world's finest collections of models of American craft based exclusively on authentic plans.

Medical Sciences

Reference collections including drugs, apothecary jars, and other artifacts of pharmaceutical history; dental instruments; surgical instruments; artifacts relating to the history of medicine, dentistry, and public health.

A reference library of professional journals, catalogues, and reference works on the history of medicine, pharmacy, dentistry, and public health.

Mechanical and Civil Engineering

Tools: a small collection of machine tools representing American innovations of the nineteenth century, backed up by a large collection of hand tools, catalogs, and documents.

Light machinery: large collections of typewriters, phonographs, clocks, and watches, including the large, recently acquired Read collection of phonographs containing such rarities as the Edison coin-operated phonograph of 1897; and the Arthur collection of some 2,600 time-keeping devices, especially remarkable for Japanese and early American clocks and American watches.

Heavy machinery: large collections of models and full-size steam, internal-combustion and water-power prime motion and pumping, refrigeration and materials-handling machinery, much of which represents pioneer developments, including 1/12 scale models of the famed "Louisville pumping engine" and the huge IRT subway engine-generators, two masterpieces of nineteenth-century steam engineering.

Leavitt Collection of Engineering Drawings: from the office of Erasmus D. Leavitt (among the most eminent mechanical engineers of his day), approximately 3,000 linen drawings of his designs for pumping, winding, and driving engines and associated machinery for the Calumet and Hecla copper mines, covering the period 1874–1905.

Frick Business Papers Collection: business correspondence of George Frick, Waynesboro, Pa., builder of agricultural and refrigeration machinery, covering the period 1853–1890.

Skinner Collection: large group of records, internal correspondence, marketing reports, test data, etc., on the operations of the leading American builder of uniflow steam engines.

Barnaby and Kates Collections: records and data on the development of the Diesel engine in the United States, 1910–1940, gathered by two leading designers.

McCormick Collection: small grouping of original documents and letters on the work of John B. McCormick, inventor of the "American" type of hydraulic turbine.

Civil engineering: large collections of archival material in various branches of the field, particularly in the history and development of bridge and tunnel engineering.

Forgie Collection: large collection of drawings, photographs, and design and contract documents covering the construction of a number of major and minor American tunnels, 1900–1950.

Westinghouse Collection: Complete drawing files of the Westinghouse Machine Company for their line of large and small steam and gas engines and steam turbines, 1880–1920. Supported by a large group of shop photographs.

Rudolph Hering Collection: the pamphlet library of the prominent American sanitary engineer, covering this field extensively for the second half of the nineteenth century.

ARTS AND MANUFACTURES

The collection in arts and manufactures includes a wide variety of subjects with a concomitant diversity of research opportunities. Students and scholars will be interested in two approaches to research, the esthetic and the industrial, for the research staff within this field is equipped to deal not only with the products of the various arts but also with the history of the means of producing them.

Agriculture and Forest Products

Collections in agriculture and forest products provide research scholars with examples of American agricultural implements and machinery of every time period, with special emphasis on the evolution of ninteenth-century plowing and harvesting equipment. Researchers interested in the development of forest products may profitably use the collection of woods and tools and woodworking machines of the eighteenth and ninteenth centuries. The food technology collection contains many items dealing with dairy processing and dairy husbandry. This section has some 1,500 specimens, ranging from wood chisels through model tractors to giant wheat combines. In addition, there is a library of some 600 volumes.

Ceramics and Glass

Research objectives in the ceramics and glass collections include the discovery and compilation of new information, verification of existing attributions, and historical, esthetic, and technical aspects of the study of ceramics and glass. The areas of most intensive coverage in this division comprise fourteenth to twentieth century European and American ceramics, American and Old World glass of all periods, Oriental ceramics made for export to America and elsewhere, and Oriental wares which influenced American and European productions.

The professional staff cooperates with other Smithsonian researchers and with other divisions within the Museum of History and Technology. It also cooperates in archeological research, classification, and excavation with such outside institutions as the Department of Archeology of Michigan State University, the Corning Museum of Glass, and Colonial Williamsburg.

Comprehensive research material is provided by the Syz Collection of eighteenth century European porcelain; the Larsen Collection of ninteenth century transfer-printed English earthenware decorated with American views; the McCauley Collection of late eighteenth and early ninteenth century English Liverpool-type earthenware decorated with American views; early American glass, including rare examples of Sandwich, pressed lacy, and blown three mold; late ninteenth and early twentieth century American art glass, such as Tiffany, Carder Steuben, etc.; and other specialized groups.

Graphic Arts and Photography

Research in graphic arts and photography centers on the history and technology of significant areas of both subjects and the documentation of the collections.

Research facilities include a library of approximately 3,000 volumes and a collection of about 50,000 specimens, representing prints of all periods, with particular strength in photomechanical prints of the pioneer period 1850–1900. The division also has a moderately good representation of American etching from the 1880s and 1890s, as well as some early hand presses. Recent acquisitions include a splendid set of 31 Venetian views by Antonio Canal (1697–1768), commonly called Canaletto, constituting the entire body of his published etchings, and outstanding examples of German Expressionist printmaking, including work by Max Beckmann, Ernst Ludwig Kirchner, Erich Heckel, Franz Marc, Max Pechstein, Emil Nolde, and Kaethe Kollwitz.

Research objectives in photography are concerned with its history and technology and a long-range program of increasing the collections of periodicals, monographs, and books devoted to the history and practice of photography. Among the research facilities are more than 5,000 publications, 250 photographic lenses and shutters, 1,500 still and motion-picture cameras, a collection of one-shot color and aerial cameras, and a representative group of equipment documenting the history of news photography. The photographic collection includes more than 300 Patent Office models covering the period 1840-1905, an assortment of early darkroom processing materials used for daguerreotype, wet-plate, and silver-halide processes, and an important collection of photographs documenting the history of photography.

Old photographs constitute important historical documents. Recognizing that image discoloration and fading were making old photographs in the Smithsonian's collections useless for reference or exhibition, Eugene Ostroff, curator of photography, devised a new technique for restoring them through neutron irradiation. This process has been used to treat a small selection of the most valuable photographs.

Work is now proceeding on the production of a catalogue raisonne of the photographs and photomechanical reproductions of the William Henry Fox Talbot collection from his ancestral home, Lacock Abbey, Chippenham, England.

Manufactures and Heavy Industries

Research in the division of manufactures and heavy industries concerns the collection and documentation of machines, equipment, and artifacts related to the history of the discovery and application of nuclear energy to peaceful uses and the history of the technology of petroleum, iron and steel, mining and metallurgy, coal, and general manufactures. Research facilities include the Holley Collection of engineering drawings of the first Bessemer plants in the United States; the Dewey Collection in economic geology and metallurgy; the Jewett Collection of tinsmith's ware; the Grant Wheat Collection of underground lighting; some 1,000 patent models, particularly those related to shoe manufacture; and a reference library of some 1,400 volumes. This section is especially interested in American industrial development of the ninteenth century, such as the development of machinery and techniques in the manufacture of consumer nondurables in metals, plastics, and leather, and in the international communication of technological advances in the processes of manufacture.

Textiles

Research objectives of the division of textiles concern the establishment of a comprehensive collection of fabrics made or used in America from the seventeenth century to the present, fabric name citations, contemporary technical descriptions for the early fabrics and cross-references to their closest modern counterparts, and studies of the art, household, or costume use of each fabric. Textile implements and machines and the development of methods and standards for the preservation of textile materials under modern exhibition and storage conditions are also of interest. The collections consist of some 40,000 items, including fibers, fabrics, implements used to make and process them, and many important textile-related patent models dating from 1836 to 1880. The fabric collections, which date from the seventeenth century to the twentieth century, are most complete in the type of fabric item made or used in America during the 19th century.

This section staffs a small laboratory for the scientific cleaning of textiles in the museum collections. It cooperates with other museum Divisions having related textile conservation problems. The results of this work are made available to the public on request.

Research Staff

RITA J. ADROSKO, Associate Curator, Division of Textiles. 1952: B.S., Syracuse; 1957: M.A., Michigan State; 1957–1960: Instructor, Michigan State University; 1960–1961: School of Industrial Arts, Helsinki; 1961–1962: Fabric Designer, Milliken Woolens; 1962–1963: Assistant Professor, University of Wisconsin. Specialties: pattern weaves in Europe and America in the 17th, 18th, and 19th centuries, and the use of natural dyes in America. Book: *Natural dyes in the United States* (1968). Articles: "Summer and Winter Weave," *Enc. Brit.* (1966); "Woven Structure and Design," *L'Industrie textile* (1967). Speaks French.

EDWIN A. BATTISON, Associate Curator of Mechanical and Civil Engineering (Curator of Horology and Light Machinery). Specialty: history of mechanical technology; current research on history of American technology. Articles: "The Auburndale Watch Company," *Cont. from the Mus. of Hist. and Tech.* (1959); "Screw-Thread Cutting by the Master-Screw Method Since 1480," *Cont. from the Mus. of Hist. and Tech.* (1964); "One Hundred Years of Machine Tool Progress," *Metalworking* (1965); "Stone-Cutting and Polishing Lathe by Jacques Besson," *Technology and Culture* (1966); "Eli Whitney and the Milling Machine," *Sm. Journ. of Hist.* (1966).

SILVIO A. BEDINI, Assistant Director. 1935–1942: Columbia University. Specialty: history of scientific instruments and the mathematical practitioner; current research on the history of early American scientific instruments and the mathematical practitioner, history of horology, scientific instrumentation in 14th- through 17th-century Italy. Fieldwork: European museums and archives. Books: *The Scent of Time* (1963); *Early American Scientific Instruments and Their Makers* (1964); with Francis R. Madison, *Mechanical Universe* (1966); *The Sign of the Quadrant* (in press). Articles: "The Instruments of Galileo Galilei," *Man of Science* (1967); "Galileo Galilei and the Measure of Time," *Saggi su Galileo Galilei* (1967); "The 17th Century Table Clepsydra," *Physis* (1968). Speaks French, Italian.

PHILIP W. BISHOP, Chairman. 1927: B. Comm., London School of Economics; 1950: Ph.D., Yale; 1939–1942: Instructor, Yale University; 1942–1945: Instructor, Oberlin College; 1946–1960: Associate Professor, Yale University. Specialties: Alexander Lyman Holley's contributions to American steel factory planning, history of metal fabrication in America and Great Britain, Andrew Ure's influence on the communication of technological information (1800–1850); current research on the U.S. iron industry before 1860. Books: co-author, *Moments of Discovery* (1958); *The Beginnings of Cheap Steel* (1959); chapter "L'Introduction des techniques modernes sur le nouveau continent" in *Histoire generale des techniques* (1967). Speaks French, Italian.

DANIEL J. BOORSTIN, Director. 1934: B.A., Harvard; 1936: B.A. (Jurisprudence), Balliol College, Oxford; 1940: S.J.D., Yale; 1968, Litt. D., Cambridge University: 1938–1942: Instructor, Harvard College and Harvard Law School; 1942–1944: Instructor, Swarthmore College; 1944–1969: faculty appointments, Preston and Sterling Morton Distinguished Service Professor of American History, University of Chicago; 1950–1951: visiting professor of American History at the University of Rome; 1953: consultant to Social Science Research Center at the University of Puerto Rico; 1957: visiting professor of American History at the University of Kyoto, Japan, and lecture tour in Korea; 1959–1960: lecture tour for United States State Department in Turkey, Iran, Nepal, India, and Ceylon; 1961–1962: first incumbent of chair of American history at the Sorbonne (University of Paris); 1964–1965: Pitt Professor of American history and Institutions, Cambridge University and Fellow of Trinity College, Cambridge; 1968: lecture tour for the State Department in Indonesia, Australia, New Zealand, and Fiji. Books: *The Americans: The Colonial Experience* (1958); *The Americans: The National Experience* (1965); *The Image: A Guide to Pseudo-Events in America* (1964); *The Genius of American Politics* (1953); *America and the Image of Europe* (1960); *The Lost World of Thomas Jefferson* (1960); *The Mysterious Science of the Law* (1958); editor, *Chicago History of American Civilization and An American Primer* (1966). 1967–present: Member, American Revolution Bicentennial Commission.

WALTER F. CANNON, Curator of Physics and Geoscience. 1947: B.A., Princeton; 1949: M.A., Harvard; 1956: Ph.D., Harvard; 1955–1961: Instructor and Assistant Professor, Massachusetts Institute of Technology; 1955–1962: Visiting Assistant Professor, University of California, Berkeley; 1964–1965: Professorial Lecturer, George Washington University; 1966: Visiting Professor, University of Pennsylvania. Specialty: history of British science in the 19th century; currently writing biography of John Herschel and doing research in Victorian science. Fieldwork: England. Articles: "The Uniformitarian-Catastrophist Debate," *Isis* (1960), "History in Depth: The Early

Victorian Period," *Hist. of Sci.* (1964); "Scientists and Broad Churchmen: An Early Victorian Intellectual Network," *Journ. of British Studies* (1964); "William Whewell," *Notes and Rec. of the Royal Soc.* (1964); "P.S. If I find out what Truth is, I'll drop you a line," *Smithsonian Journal of History* (1967).

HOWARD I. CHAPELLE, Senior Historian. Studied at Webb Institute of Naval Architecture; 1932–1956: naval architect; 1970: Member of Faculty, Munson Institute. Specialties: histories of American naval architecture and shipbuilding; current research on the development of North Atlantic fishing schooners, 1825–1935. Books: *The History of American Sailing Ships* (1935); *The History of the American Sailing Navy* (1949); *American Small Sailing Craft* (1951); *The National Watercraft Collection* (1960); *The Bark Canoes and Skin Boats of North America* (1964); *The Search for Speed under Sail in North America. 1700–1855* (1967). Article: "The Constellation Question," (in press).

MRS. ELVIRA ELIZA CLAIN-STEFANELLI, Curator, Division of Numismatics. 1938: M.A., Cernauti, Rumania; 1940–1942: Fellow, Rumanian Academy, Rome; 1947–1956: Free-lance writer, Rome, Italy and New York City. Specialties: history of money and medallic art (particularly ancient Greek coins from Sicily and South Italy), modern gold coins, and the art of the medal. Fieldwork: Archives and numismatic collections in museums in Rome, Naples, Milan, Turin, Gotha, Dresden, Munich, Berlin, Prague, Vienna, Madrid, Stockholm, Copehhagen, London, Cambridge, Oxford (1941–1967). Current research on Latin American gold coins, numismatic bibliography, coins of ancient Greek Messana. Books: *Russian Gold Coins* (1962); *Select Numismatic Bibliography* (1965); chapter "Etats-Unis," *Exposition internationale de la medaille actuelle* (1967); chapter "The United States, Canada, Central and South America," vol. III, *A Survey of Numismatic Research, 1960–1965* (1967). Articles: "Gold Coins of the 19th and 20th Centuries," *Canadian Num. Journ.* (1959); "Numismatics–An Ancient Science, A Survey of Its History," *Cont. from the Mus. of Hist. and Tech.* (1965); "Italian Coin Engravers since 1800," *Cont. from the Mus. of Hist. and Tech.* (1965); "The United States, Canada, Central and South America," *A Survey of Numismatic Research 1960–1965* (1967); "L'evolution artistique de la medaille aux Etas Unis," *Medailles* (1968). Speaks German, French, Italian, Rumanian.

VLADIMIR CLAIN-STEFANELLI, Curator, Division of Numismatics. 1936: M.A., Cernauti-Czernowitz, Rumania; 1938: Ph.D., Cernauti-Czernowitz; 1939–1940: Fellow, Rumanian Academy, Rome; 1937–1938: Museum Assistant, Museul Regele Carol II (formerly Bukowiner Landesmuseum), Cernauti-Czernowitz; 1939: in charge of Greek coin corpus, Prussian Academy of Sciences. Specialties: coinages of the Greek colonies on the western Black Sea coast, 15th-and 16th-century southern European issues, historical documentation of U.S. coinages, history of money and medallic art; current studies on application of scientific methods of research in numismatics, such as X-ray diffraction using back-reflection techniques as a nondestructive method for distinguishing between struck (authenic) and cast (false) coins. Fieldwork: public and private collections throughout the world. Books: sections of *Ex Nummis Historia*–"Reges Macedoniae," "Alexandri Magni Succesores" in vol. I–*Greek Coins* (1949), all vol. II–*Aes Grave* (1949), all vol. III–*Coins of Trajan, Hadrian, and Their Families* (1950), all vol. IV–*Roman Coins from Antoninus Pius to the Fall of the Western Empire* (1951). Articles: Genuine or False? The Application of X-ray Fluorescence Analysis in the Authentication of Coins," *The M.A.N.A. Journ.* (1963); "A New Quarter Shekel of the First Year of the Jewish War," *Israel Num. Journ.* (1964); "The Future of the United States Coinage," *The Numismatist* (1964); "Money," *The*

World Book Enc. (1965); "Historical Notes on Coinage Metals," *Coins* (1965); "Monetary History and Medallic Art at the Smithsonian Institution," *Numisma* (1965); "Birds on Coins," *Birds in Our Lives* (1966); "Numismatics Re-Examined," *The Canadian Num. Journ.* (1967); "History of the National Numismatic Collections," *Cont. from the Mus. of Hist. and Tech.* (1968). Speaks German, French, Italian, Rumanian.

MRS. GRACE ROGERS COOPER, Curator, Division of Textiles; Senior Technical Editor, Textiles, *Encyclopaedia Britannica.* 1946: B.S., Maryland. Specialties: textile implements and machines, textiles made or used in the United States, preservation (conservation) of antique fabrics; current research on spinning wheels and printed fabrics in America. Books: *Scholfield Wool-Carding Machine* (1959); *Invention of the Sewing Machine* (1968). Articles: "Textiles and Textile Machines," *Tech. and Culture* (1961); "Origin and Development of the Loom," *Enc. Brit.* (1967). Absence: Sabbatical in calendar year 1970.

AUDREY B. DAVIS, Assistant Curator, Division of Medical Sciences. 1956: B.S., Adelphi; 1969: Ph.D., Johns Hopkins. 1956–1959: science teacher, Sewanhaka High School; 1960–1961: science teacher, Saugus High School; 1961–1962: science teacher, Windsor School, Boston. Specialty: 17th-century medical chemistry; current research on 17th and 18th century medical chemistry and anatomy lectures. Instrumentation and techniques: history of microscopes. Fieldwork: Cancer Institute, Port Washington, N.Y. Articles: "Science Service," *Handbook of Sci. Projects* (1965); "The Circulation of the Blood and Chemical Anatomy," (in press).

JON B. EKLUND, Assistant Curator, Division of Physical Sciences (Curator of Chemistry and Metrology). 1958: B.S., Yale; 1966: M.A., Wesleyan; 1963–1967: Yale; 1965: Instructor in Physics, Wesleyan University. Specialty: history of chemistry; current research on chemical analysis in the 18th century; 18th and 19th century metrology. Speaks German.

BERNARD S. FINN, Curator of Electricity. 1955: B.E.P., Cornell; 1963: Ph.D., Wisconsin; 1955–1958: Physicist, E. I. du Pont; 1961–1962: Instructor, University of Oklahoma; 1964–1966: Lecturer, Catholic University of America. Specialties: 19th-century physical sciences, and electricity; current research on 18th century electrostatics and 19th century telegraphy. Book: *Sources in Thermo-electricity* (1967). Articles: "Laplace and the Speed of Sound," *Isis* (1964); "The New Technical Museums," *Mus. News* (1964); "The Science Museum Today," *Technology and Culture* (1965); "Controversy and the Growth of the Electrical Art," *IEEE Spectrum* (1966); "Alexander Graham Bell and the Variable Resistance Transmitter," *Am. Journ. of Hist.* (1967); "Thomson's Dilemma," *Physics Today* (1967); "Inconsistencies in Franklin's Theory," *Isis* (1969). Speaks French.

PAUL V. GARDNER, Curator-in-Charge, Division of Ceramics and Glass. 1930: B.S., Alfred; 1947: University of Miami; 1929–1931: Designer and Assistant to the Manager, Steuben Division, Corning Glass Works; 1931–1943: Assistant to the Art Director and Designer, Corning Glass Works. Specialties: Carder Steuben glass of the period 1903–1932, American and European glass of the 18th, 19th, and 20th centuries, European porcelain of the 18th and 19th centuries, ancient glass from 1500 B.C. to 1200 A.D.; current research on 18th-century European porcelain, also writing a technical biography of Frederick Carder (1863–1963). Books: *Meissen and Other German Porcelain in the . . . Pell Collection* (1956,1966); *Glass from Private American Collections and the Smithsonian Institution* (1962). Articles: "Earthenware," "Chinaware," *Enc. Brit.* (1964); "Great Glass at the Smithsonian," *Antiques* (1964); "Eighteenth-Century Porcelain at the Smithsonian," *Antiques* (1965).

SAMI K. HAMARNEH, Curator, Division of Medical Sciences, 1948: B.S., Syrian, Damascus; 1956: M.S., North Dakota State; 1959: Ph.D., Wisconsin; 1955–1956: Instructor, North Dakota State; 1964: Associate Professor, University of Pennsylvania; 1969: Visiting Professor, University of Pennsylvania. Specialty: history of pharmacy and medicine in Islam; current research on pharmacology and medical therapy in medieval Islam. Special techniques: identification of medical and pharmaceutical tools and their use and development. Fieldwork: Middle East, British Museum Library. Books: *Customs and Civilizations in Bible Lands* (1960); with Glenn Sonnedecker, *A Pharmaceutical View of Abulcasis al-Zahrawi in Moorish Spain* (1963); *Bibliography of Medicine and Pharmacy in Medieval Islam* (1964); *Index of Arabic Manuscripts on Medicine and Pharmacy at the National Library, Cairo* (1967). Articles: "Development of Hospitals in Islam," *Journ. Hist. Med. and Allied Sci.* (1962); "Rise of Professional Pharmacy in Islam," *Med. Hist.* (1962); "Climax of Chemical Therapy in 10th Century Arabic Medicine," *Dev. Islam* (1963); "Origin and Functions of the Hisbah System in Islam and Its Impact on the Health Professions," *Sudhoffs Archiv. f. Gesch Med.* (1964); "Al-Kindi, a Ninth-Century Philosopher, Physician, and Scholar," *Med. Hist.* (1965); "Arabic Historiography as Related to the Health Professions," *Sudhoffs Archiv* (1966); "The Climax of Medieval Arabic Professional Pharmacy." *Bull. Hist. of Med.* (1968); "Dental Technology at the Smithsonian Dental Exhibit," *National Assn. of Certified Dental Laboratories Journal* (1969). Speaks Arabic.

ELIZABETH M. HARRIS, Assistant Curator, Division of Graphic Arts. 1962: B.A., Reading (England); 1965: Ph.D., Reading. Specialties: printing and engraving in England in the 19th century, photomechanical processes of the period 1840–1900. Fieldwork: England and Scotland; currently cataloging photomechanical collection and doing research on the construction of English and American wooden common presses. Article: "Sir William Congreve and His Compound Plate Printing," *Cont. from the Mus. of Hist. and Tech.* (1967).

JOHN N. HOFFMAN, Associate Curator, Division of Agriculture and Mining (Section of Mining). 1943: B.S., Pennsylvania State; 1948: M.S., Pennsylvania State; 1943–1944, 1946: Engineer, Pittsburgh Coal Company; 1953: E.M., Pennsylvania State; 1961: Ph.D., Pennsylvania State; 1948–1960: Instructor, Pennsylvania State University; 1962–1964: Editor, *Mechanization.* Specialties: mechanization of the U.S. coal industry, canal and railroad transportation of anthracite in the 19th century; currently preparing a script for the Smithsonian Mining Hall, and doing research on anthracite transportation methods in the 19th century and mechanization of the U.S. coal industry. Fieldwork: Pennsylvania. Books: *Manganese–Its Minerals, Deposits and Uses* (1957); co-author, *Materials Survey of Tin* (1953); co-author, *Coal Preparation Handbook* (1957); co-author, *Future Energy Sources for Pennsylvania* (1958). Articles: "Major Economic Changes in the Mining and Distribution of Pennsylvania Bituminous Coal," *Mechanization* (1960); "Progress in Preparation, 1937 to 1962," *Mechanization* (1962); "Coal on the Way Up," *Mechanization* (1963); "Underground Spotlight," *Mechanization* (1963); "Coal in Review–1963," *Mechanization* (1964); "State Review of Coal Production," *Mechanization* (1964); "Anthracite in the Lehigh Region of Pennsylvania, 1820-45," *United States National Museum Bulletin* (1968).

M. H. JACKSON, Curator, Division of Transportation (Curator of Marine Transportation). 1946: Master Mariner Unlimited; 1950: B.A., Miami; 1952: M.A., Harvard; 1956: Ph.D., Harvard; 1936–1949: Officer, Merchant Marine; 1952–1960: Instructor and Assistant Professor, University of Miami. Specialties: history of privateering, the Caribbean, cartography and navigation, early voyages of discovery, the sailing ship, the Industrial Revolution; current research on 18th century cannon manufacturing industry. Fieldwork: St. Mary's City, Maryland, underwater and field archeology of 17th century settlement in summer and fall of 1969. Book: *Charleston: A Privateering Palatinate, 1793–1796* (1969). Articles: "The Economy of the French Caribbean," *The Caribbean* (1958); "The Consular Privateers: 1793–1794," *Am. Neptune* (1962); "The Labrador Landfall of John Cabot," *Canadian Hist. Rev.* (1963); "The Defense of the Cutter *Eagle:* A New View on Negro Head," U.S. Coast Guard *Bul.* (1964); "Salt, Sugar and Slaves: The Dutch in the Caribbean," James Ford Bell Lecture (1965); "Greenland the 'Vinland Map,' " *The Cartographer* (1966); "Charleston: A Privateering Palatinate, 1793–1796" (1967). Speaks French, Spanish.

UTA C. MERZBACH, Associate Curator-in-Charge (Curator of Mathematics). 1952: B.A., Texas; 1954: M.A., Texas; 1965: Ph.D., Harvard; 1966: Visiting Professor, University of Pennsylvania. Specialty: history of modern mathematics and development of mathematical logic. Article: "Leibniz's Mathematics in the Context of His Times," *Proc. Leibniz Sym. 1966* (1967). Speaks German, French.

J. JEFFERSON MILLER II, Associate Curator, Division of Ceramics and Glass. 1950: B.A., Johns Hopkins; 1953: L.L.B., Maryland; 1962: M.A., Delaware; 1960–1962: Winterthur Museum. Specialties: 18th- and 19th-century English transfer-printed earthenware made for the American market, 18th-century European porcelain, classification of ceramics from archeological excavations at American historical sites; currently cataloging Hans Syz and Robert H. McCauley Collections. Fieldwork: Mackinaw City, Mich. Articles: "The Designs for the Washington Monument in Baltimore," *Journ. of the Soc. of Architectural Historians* (1964); "Transfer Printed English Earthenware for the American Market," *Apollo* (1965); "Early Meissen Tea Canisters," *Country Life* (1965); "The Larsen and McCauley Collections at the Smithsonian Institution," *Antiques* (1965); *Baltimore's Washington Monument,* visitor handbook, Peale Museum, Baltimore; "Unrecorded American Views on two Liverpool-Type Earthenware Pitchers," *Winterthur Portfolio* (1968).

ROBERT P. MULTHAUF, Senior Scientific Scholar; Professorial Lecturer in the History of Science, George Washington. 1941: B.S., Iowa State; 1950: M.A., California, Berkeley; 1953: Ph.D. California,Berkeley; 1961: Teacher, University of Pennsylvania. Editor, *Isis.* Specialty: history of technology. Book: *The Origins of Chemistry* (1967).

REIDAR NORBY, Assistant Curator, Division of Postal History. 1936: graduate, Polytechnic Institute, London; 1936–1939: Oslo University. Specialty: Scandinavian and Central European philately and postal history; current research on 19th-century U.S.–European postal relations, method of production of classic Norwegian stamps, cataloging of postal stationary of the world. Instrumentation and techniques: the use of enlarged tracings and photo positives for determining types and variations of printings of postage stamps, can also be applied to detection of forgeries and counterfeits. Articles: "Norway–Coat of Arms Issue 1863–66: One Original Drawing for All Denominations," *Thirteenth Am. Philatelic Cong. Yearbook* (1964); "Scandinavian Stamp Lexicon," *Scand. Scribe* (1965,1966,1967); "The Smithsonian's Swedish Mail Box," *The Posthorn* (1967); "Norwegian 'Local' Stamps–on Madagascar," *The Posthorn* (1967); "An Answer to the Stamp Theft Problem," *The Posthorn* (1968); "Gummy Observations," *Scandinavian Scribe* (1968); "Counterfeit Overprints on Danish Newspaper Stamps," *Scandinavia Scribe* (1968); "Project Smithsonian," *The Posthorn* (1968); "Smithsonian's Role in Philately," *SPA Journal* (1969); "8 advance skillings–Letters from out of the Past, and What They Tell Us," *American Swedish Historical Foundation Yearbook 1968* (1969); "Glimpsing at Scandinavian History–Through Philatelic Peepholes," *Gibbons–Whitman Stamp Monthly* (1969). Speaks Danish, Norwegian, Swedish, German, French.

EUGENE OSTROFF, Supervisor, Division of Graphic Arts, and Curator of Photography. 1950: B.A., New York; 1955–1958: Graduate School of Engineering, Columbia; 1956–1960: Supervisor of Technical Services, Ilford, Inc. Specialties: preservation and restoration of photographs, history of photography; current research on early photographic and photomechanical processes; early photographic patents; the work of W. H. F. Talbot of England; preservation and restoration of photographs. Articles: "Early Fox Talbot Photographs and Restoration by Neutron Irradiation," *Journ. of Photo. Sci.* (1965); "Restoration of Photographs by Neutron Activation," *Science* (1966); "Talbot's Earliest Extant Print, June 20, 1835, Rediscovered," *Phot. Sci. and Eng.* (1966); "Preservation of Photographs," *Phot. Journ.* (1967); "Image Reproduction: Photography and Photomechanics," *The Photographic Journal* (1969). Speaks French.

CARL H. SCHEELE, Associate Curator-in-Charge, Division of Postal History. 1953: graduate, Cleveland Institute of Art; 1953: B.F.A., Illinois; 1957: M.A., Western Reserve. Specialty: U.S. philately and postal history; current research on U.S. pneumatic tube postal service, 19th-century letter carrier service, 19th-century revenue stamp plate proofs, general survey of foreign, colonial, and U.S. postal history. Book: *Owney, Mascot of the Railway Mail Service* (1967). Articles: "A New Home for the Smithsonian's Philatelic and Postal History Collections," *The* [Am. Philatelic] *Cong. Book* (1964); "A Philatelic New Look at the Smithsonian," *Soc. of Philatelic Am. Journ.* (1964); "The Mitsui Donations to the Smithsonian Institution," *Japanese Philately* (1964); "Philately and Postal History at the Smithsonian Institution," *Scand. Scribe* (1965); "The Pneumatic Tube Mail Service in the United States," *Soc. of Philatelic Am. Journ.* (1966); with Victor H. Weill, "Postal Issues of France and Colonies at the Smithsonian . . .," *France and Colonies Philatelist* (1966); "The National Postage Stamp Collection: Smithsonian Institution," *Minkus Stamp Journ.* (1967); " 'Zoned' Addresses–The Early Experiments," *Soc. of Philatelic Am. Journ.* (1967); "On the 'Wilderness' of Philatelic Scholarship," *The* [Am. Philatelic] *Cong. Book* (1967).

JOHN T. SCHLEBECKER, Curator, Division of Agriculture and Forest Products; Summer Session Professor of History, 1969, University of Maryland. 1949: B.A., Hiram; 1951: M.A., Harvard; 1954: Ph.D., Wisconsin; 1954–1956: Associate Professor, University of Montana; 1956–1965: Associate Professor, Iowa State University. Specialties: History of agriculture, U.S.; current research on the scientific and technological development of American agriculture, the creation of operating historical farms, and agriculture during the American Revolution. Books: co-author, *A History of Dairy Journalism in the United States* (1957); *Cattle Raising on the Plains, 1900–1961* (1963); *A History of American Dairying* (1967); *Living Historical Farms: A Walk into the Past* (1968); editor, *Eighteenth Century Agriculture: A Symposium* (1969).

ROBERT M. VOGEL, Curator, Division of Mechanical and Civil Engineering (Curator of Heavy Machinery and Civil Engineering). 1954: B. Arch., Michigan; 1954–1956: Chief Draftsman, Construction Battalion, U.S. Army Corps of Engineers; 1956–1957: Field Engineer, Panitz Brothers, Baltimore. Specialties: history of civil engineering and mechanical engineering, particularly power machinery, and industrial archeology in the U.S.; current research on the development of high-speed and uniflow steam engines, and the development of mill architecture in New England. Special techniques: fieldwork in industrial archeology. Fieldwork: New England, Pennsylvania, Maryland. Articles: "The Elevator Systems of the Eiffel Tower–1889," *Cont. from the Mus. of Hist. and Tech.* (1963); "The Engineering Contributions of Wendel Bollman," *Cont. from the Mus. of Hist. and Tech.* (1964); "Tunnel Engineering, a Museum Treatment," *Cont. from the Mus. of Hist. and Tech.* (1964). "Some Speculation on the History and Appearance of a

Bollman Truss" (1967); "Industrial Archaeology at the Smithsonian Institution: An Interim Report," *Technology and Culture* (1967); "Industrial Archaeology–A Continuous Past" *Hist. Preservation* (1967).

JOHN HOXLAND WHITE, Jr., Curator, Division of Transporation (Curator of Land Transportation). 1958: B.A., Miami (Ohio). Specialties: 19th-century railroad equipment design, and locomotives, cars, rails, and the builders thereof; current research on American railroad cars, design and construction. Instrumentation and techniques: reconstruction drawings of 19th century railroad apparatus. Fieldwork: Copiapo, Chile. Books: *Cincinnati Locomotive Builders: 1845–1868* (1965); *American Locomotives, an Engineering History 1830–1880* (1968). Articles: "The Mt. Adams and Eden Park Inclined Railway," *Bull. of the Hist. and Philos. Soc. of Ohio* (1959); "The Janus," *Journ. of Transport Hist.* (1964); "Locomotives on Stone," *Smithsonian Journ. Hist.* (1966); "James Millholland and Early Railroad Technology," *U.S. National Museum Bulletin* 252(1967); "The Cincinnati Inclined Plane Railway Company: The Mount Auburn Incline and Lookout House," *Cincinnati Hist. Soc. Bull.* (1969).

NATIONAL AIR AND SPACE MUSEUM

The Smithsonian's interest in aeronautics and space flight is of long standing. Since 1876 the Institution has been gathering and safeguarding examples of kites, balloons, aeronautical equipment, and flightcraft, including the Wright Brothers' 1903 Flyer, Lindbergh's "Spirit of St. Louis," and John Glenn's "Friendship 7."

In this book the National Air and Space Museum comes under the category of American Studies and also (along with the National Museum of History and Technology, the Joseph Henry Papers and the Archives) under the category of History of Science and Technology.

Possibilities for Research

Unique opportunities for research in all forms of flight materiel, covering the entire history of aerospace development from balloons to spacecraft, are available at the National Air and Space Museum, established in 1946 with the primary purpose of increasing and facilitating the diffusion of knowledge in matters related to the aerospace sciences.

The Museum is organized in three Departments: Aeronautics, Astronautics, and Information and Education. The activities and interests of the National Air and Space Museum already include rockets, guided missiles, and space science and technology. To handle the growing series of space specimens and documentation in the new Department of Astronautics, a curatorial staff specializing in space vehicle design, launch and propulsion technology, auxiliary systems development, and life support techniques is being recruited.

Access to a wide spectrum of documentation is offered to the scholar, researcher, or author. Within the Historical Research Center of the Information and Education Department a specialized branch library of the Smithsonian Institution is supplemented by extensive subject files in fields unique to air and space. The collection includes the personal memorabilia of many of the prominent pioneers. Unusual time periods in history are covered as in the case of World War II and the developments which later led to space travel. This era is represented with 650,000 feet of microfilm. Extensive document files covering the many individual devices of air and space from propulsion to instrumentation are supplemented by drawing and photograph collections numbering in the hundreds of thousands. An audiovideo program which includes sound motion pictures and oral history taped interviews is rapidly expanding.

Collections

The Museum has in its possession the largest collection of historical aerospace material in the world. In addition to the specimens currently on display in the very limited facilities at present available, the Museum's reserve collections, concentrated principally in a 15-acre depot at Silver Hill, Md., contain some 200 aircraft of all types of great technical and historical significance (most of which are irreplaceable); more than 200 aircraft engines of importance and large quantities of miscellaneous components; numerous rockets and guided missiles; and more than 750 aircraft models.

Facilities Planned

By the mid-1970s it is hoped that a new National Air and Space Museum building will be completed on the Washington Mall. A monumental structure that will accommodate more than 50,000 visitors daily, the NASM will make possible the first comprehensive display of the national aerospace collection of the Smithsonian, less than 5 percent of which is now available for viewing.

Special exhibition areas will feature educational displays explaining aerospace environmental science and technology. Also included in the Museum will be an extensive research center with a library and study, seminar, and conference rooms. Scholars, writers, historians, and professionals in various disciplines will work with the Museum's extensive reference library to create an unrivaled center of learning in the history and development of air and space exploration.

Objectives

For the millions of people who are expected to visit the new facility yearly, the Museum contemplates displays which present in clear and understandable fashion a balanced story of aerospace development. For serious researchers in aerospace technology and history, the Museum is reorganizing its already extensive research resources and making them more readily available. For those who need to examine aerospace hardware, the documentation of the study collection at Silver Hill, Md., is being improved and the specimens more conveniently arranged for study.

The Museum maintains close associations with other aeronautical museums, both in this country and abroad, and also works closely with many professional scientific and historical societies. It is, for example, the official repository for material and memorabilia for such organizations as the Lafayette Escadrille, the Early Birds, the Air Mail Pioneers, etc.

Research Staff

LOUIS S. CASEY, Curator, Aircraft Division. Acting Assistant Director, Aeronautics Department; Chairman, Aviation Committee and Governing Board of International Association of Transportation Museums, (IATM), International Council of Museums, (ICOM); Member of Advisory Board, Washington Technical Institute; Member of Board of Consultants for *Above and Beyond* (Encyclopedia of Aviation and Space Sciences). 1938: Aero University of Chicago; 1939: Iowa State College; 1948: B.S., Parks College of Aeronautical Technology, St. Louis University; 1961–1969: American University; 1950–1951: Executive Assistant, Board of Civil Aviation, Bermuda; 1951–1956: Assistant Director, Board of Civil Aviation, Bermuda; 1956–1958: Instructor in Aviation, Norwich University. Specialties: technical history of aircraft construction, design, and operation; air transporation; evolution of Curtiss aircraft; current research on aircraft specimens (Loening OA–1A, Douglas World Cruiser). Articles: "History of the Curtiss BT–1 Flying Lifeboat," *Am. Aviation Hist. Soc. Journ.* (1965); "The First Non-Stop Coast-to-Coast Flight and the Historic T–2 Airplane," *Annals of Flight* (1965); also information leaflets on various aircraft: "Aircraft Restoration," *Am. Aviation Hist. Soc. Journ.* (1968); "Wright Flyer," "Spirit of St. Louis," and "National Air Museum," *Above and Beyond* (1968).

FREDERICK C. DURANT III, Head, Department of Astronautics. 1939: B.S. Lehigh; Naval Aviator, test pilot, Commander, United States Naval Reserve (Retired); 1948–1951: Director of Engineering, United States Naval Air Rocket Test Station; 1954–1957: Arthur D. Little, Inc.; 1957–1961: Arco Corporation; 1961–1964: Bell Aerosystems Company. Specialty: history of rockets, guided missiles, space flight. Fieldwork: Western Europe, USSR. Current Research on 19th-century developments in military rocket ordnance, lifesaving and whaling rockets. Articles: "Rockets and Guided Missiles," *Encyclopedia Britannica* (1966); "Space Exploration," *Encyclopedia Britannica* (1968); "History and Principals of Space Exploration," *Encyclopedia Americana* (1968).

PAUL E. GARBER, Assistant Director (Aeronautics) and Senior Historian. 1918: University of Maryland; 1920: Washington Research University; 1922: National Aviation School; 1926: DeZapp School of Languages: 1938, 1946: Department of Agriculture Graduate School; 1915–1916: Draftsman, Washington Aeroplane Co.; 1918–1919: various positions, Postal Aviation Service; 1920: Draftsman, National Electrical Supply Co. Specialty: history of flight, particularly general winged flight, biographical history of the Wright Brothers and Glenn Curtiss, history of air mail, and kites and their practical uses; current research on transcontinental and transatlantic flight chronology, and studies of all aspects of the history of flight. Books: *Building and Flying Model Airplanes* (1927); *The National Aeronautical Collections* (1927–1965); *Kites* (1931); *The Navy Target Kite* (1943); with A. D. Turnbull and Clifford L. Lord, *History of Naval Aviation* (1946).

ROBERT B. MEYER, Jr., Curator, Aero Propulsion. 1948: B.A., Yale; also studied at George Washington, Georgetown, American; 1943–1945: Engineering Officer and Flight Engineer, U.S. Army Air Corps; 1950–1960: insurance broker; 1967–1969: teacher of aviation education at Roosevelt High School. Specialty: piston aero engines; current research on Professor Langley's model aero engine of 1903. Fieldwork: collection of information about 1,000 aero engines throughout the world. Books: *Three Famous Early Aero Engines* (1962); *Professor Langley's Magnificent Aero Engine of 1903* (in press). Article: "The First Airplane Diesel Engine: Packard Model DR–980 of 1928, *Annals of Flight* (1964); also information leaflets on aircraft history.

ERNEST W. ROBISCHON, Assistant Director (Education and Information). 1934–1936: Curtiss-Wright Technical Institute; 1943–1945: graduate courses, Guggenheim Aeronautical Laboratory, California Institute of Technology; 1936–1945: Assistant to the Director and Instructor, Guggenheim Aeronautical Laboratory; 1945–1948: Consultant, Documentation Systems, U.S. Air Force, Technical Intelligence; 1948–1950; aircraft industry systems analysis; 1950–1963: Western Region Manager, Institute of the Aerospace Sciences, and Director of National Meetings, American Institute of Aeronautics and Astronautics; 1963–1964: Consultant, Documentation Systems. Specialties: aeronautical documentation systems development, evolutional development of aeronautical science, and NASM Oral History programs. Book: *The Evolution of the Wright Airplane* (1943). Speaks French.

NATIONAL ARMED FORCES MUSEUM ADVISORY BOARD

JOHN H. MAGRUDER III, *Director*

The National Armed Forces Museum Advisory Board was established in 1961 under the provisions of Public Law 87–186, to advise and assist the Regents of the Smithsonian Institution on matters concerned with portraying the contributions which the Armed Forces of the United States have made to national growth and development. The Secretary of Defense and the Secretary of the Smithsonian Institution serve as *ex officio* members; other members are appointed by the President. The Board is served by a professional staff having offices in the Pension Building, 440 "G" Street, N.W., Washington, D. C.

Objectives

Legislation now is pending before the Congress seeking to establish within the Smithsonian Institution a National Armed Forces Historical Museum Park and the Dwight D. Eisenhower Center for Historical Research.

The museum park will portray, by means of displays both in and out of doors, the contributions of the Armed Forces of the United States to American society and culture. The Eisenhower Center will serve as a national center for historical research into the meaning of war, its effect on civilization, the history of the American Armed Forces, and the role of national security in a modern democratic society. The Center will provide a forum for discussion, a clearinghouse of bibliographic and historical information, and a reference library to support scholarly activity.

Together, the museum park and study center will provide a rare opportunity to develop from the very outset integrated collections and programs designed to stimulate scholarship in military affairs and to contribute toward a greater awareness and understanding of the impact which military security has had on our nation's political, economic, sociological, technological, and cultural development.

Possibilities for Research

While the professional staff is focusing primarily on legislation, site acquisition, and program planning as preliminaries to actual establishment of the museum park and study center, certain of these activities offer opportunities for research.

The Board is engaged in locating and acquiring artifacts related to all aspects of military and naval history for the collections of the future museum park. Emphasis is placed on objects which possess special historical significance and which, if not acquired now, would be lost to the national collection. In arriving at value judgments regarding objects under consideration, the staff engages in—and welcomes qualified assistance in—research relating to the material aspects of military and naval history.

A major undertaking in the collection program is the salvage and restoration of the monitor USS *Tecumseh*, sunk in battle in 1864 and now resting, with all her contents still aboard, essentially intact and undisturbed on the bottom of Mobile Bay, Alabama. Upon restoration, *Tecumseh* will constitute a major display in the proposed National Armed Forces Historical Museum Park. The *Tecumseh* project will entail numerous problems in conservation, offering excellent opportunities, both on-site and in the laboratory, for practical training and for research in this field.

Opportunities for independent research exist in the library of the American Military Institute, which has been deposited with the Advisory Board to serve as a nucleus on which to build a reference library for the proposed Eisenhower Center. This valuable library consists of more than 15,000 items concentrated on military history and other areas of the social sciences having relevance to military affairs.

Research Staff

JOHN H. MAGRUDER III, Colonel, United States Marine Corps (Retired). Director, National Armed Forces Museum Advisory Board. 1941: United States Naval Academy, 1952–1969: Director, Marine Corps Museums. Established Marine Corps Museum, Quantico, Virginia; Marine Corps Memorial Museum, New Hall, Independence National Historical Park, Philadelphia, Pennsylvania. Specialty: military and naval history; military illustrator. Fieldwork: research in military and naval museums throughout United States and Europe; underwater salvage of United States monitor *Tecumseh*, Mobile Bay, Alabama. Current research on United States Navy on the Mississippi, 1862–1863 with particular emphasis on Farragut's influence on Grant during Vicksburg campaign; development of the Fleet Marine Force and the balanced fleet concept. Books: *The History of the United States Navy as Seen Through Contemporary Artists* (1963), illustrated; *Uniforms of the Marine Corps 1775–1952* (1954); *Soldiers of the Sea* (1962). Articles: "The Return of the Madison," *Saturday Evening Post* (1942); "Their Hearts Were Young and Gay," *Saturday Evening Post* (1945); "A Touch of Tradition," *Marine Corps Gazette* (1954–1959); "The Wreck of the Governor," *Leatherneck* (1955); "The Eagle, Globe and Anchor," *Marine Corps Gazette* (1968).

ROBERT M. CALLAND Project Director, *Tecumseh* Project, National Armed Forces Museum Advisory Board. 1940–1964: Regular Commissioned Officer, United States Marine Corps. Specialty: preservation of heavy military and naval equipment. Fieldwork: recovery of the monitor USS *Tecumseh*, a 2100-ton warship sunk in 1864 during the battle of Mobile Bay (Smithsonian Institution project). Current research on ship salvage, restoration, preservation, and display of historic ships and related equipment. Instrumentation: all phases of conservation of materials that have been subjected to salt water immersion.

JAMES S. HUTCHINS, Assistant Director, National Armed Forces Museum Advisory Board. 1946: B.S., United States Military Academy. 1961–1963: Chief, Historical Properties Branch, Office of the Chief of Military History, Department of the Army. Specialty: American military history. Current research on American armed forces in westward expansion; military field equipage and transport, Colonial period to World War I. Books: Chapter, "Mounted Riflemen; The Role of Cavalry in the Indian Wars" in *Probing the American West; Papers from the Sante Fe Conference* (1962); Chapter, "The Fight at Beecher Island," in *Great Western Indian Fights* (1960); *Department of the Army, Office of the Chief of Military History–Historical Properties; Classification, Cataloging, and Recording* (1963); Section, "History of Holsters," in *A Dictionary of Firearms* (1964). Articles: "The Cavalry Campaign Outfit at the Little Bighorn," *Military Collector and Historian* (1956); "Boots and Saddles on the Frontier," *Westerners Brand Book* (1956); "A Schreyvogel Bronze," *Military Collector and Historian* (1956); "Poison in the Pemmican–The Yellowstone Wagon-Road and Prospecting Expedition of 1874," *Montana, the Magazine of Western History* (1958); "Custer's Clay," *Corral Dust* (1961); "Bold Head Ewell, Frontier Dragoon," *Arizoniana, the Journal of Arizona History* (1962); "The Army Campaign Hat of 1872," *Military Collector and Historian* (1964); "Army Six-Mule Wagon Harness of 1875," *Military Collector and Historian* (1966); "The Dodge Blanket Roll Support 1892–1909," *Military Collector and Historian* (1968).

JAMES J. STOKESBERRY, Historian. 1963: B.S. Loras College; 1965: M.A. University of Delaware. Specialty: history of American science and technology, American military and naval history. Current research on strategic, economic, and sociological aspects of naval ship design and construction and naval operations of the American Civil War, as exemplified by the monitor USS *Tecumseh.* Article: "USS *Tecumseh:* Treasure in Mobile Bay," *United States Naval Institute Proceedings* (1968).

JOSEPH HENRY PAPERS

NATHAN REINGOLD, *Editor*

The Smithsonian is undertaking, in cooperation with the American Philosophical Society and the National Academy of Sciences, the publication of an edition of the unpublished papers of Joseph Henry (1797–1878), a pioneer of physics in America and the first Secretary of the Institution. The ultimate aim is the preparation of a select but extensive publication of perhaps twenty volumes, as well as a microfilm edition of all of the known Henry manuscripts.

The Henry Papers will attempt to assemble in Washington copies of all the documents now scattered in many institutions in the United States and Europe. These and the Henry manuscripts in custody of the Smithsonian Archives will form the basis of the printed and microfilm editions. In addition to work on the history of physics and cognate subjects, research on the Henry Papers will entail consideration of the history of higher education; the development of federal policy in regard to science; the origins of ethnology in America; American attitudes towards learning and research; concepts held of the relationship of theory and practice–all topics relevant to a study of Henry's far-ranging career.

Research staff

NATHAN REINGOLD, Editor, 1947: B.A., New York; 1948: M.A., New York; 1951: Ph.D., Pennsylvania; 1960–1961: Senior Postdoctoral Research Fellow, Yale University; 1959–1966: Specialist, History of Science and Technology, Library of Congress. Specialties: history of science in the United States, science in the 19th century; currently editing Joseph Henry's papers and preparing a two-volume documentary of science in 20th-century America. Book: ed., *Science in Nineteenth Century America: a Documentary History* (1964).

JAMES M. HOBBINS, Staff Historian, Joseph Henry Papers. 1965: B.A. Cornell University; 1967: M.A., Temple University. Specialty: early 19th-century American culture. Current research with S. F. B. Morse Telegraph Proprietorship and Joseph Henry, also early and mid-19th-century reformists.

STUART PIERSON, Assistant Editor. 1960: B.A., Washington. Specialty: history of chemistry; currently editing Joseph Henry's papers and doing research on the life and thought of Joseph-Louis Gay-Lussac and Claude-Louis Bertholler (1748–1822).

ARCHIVES

NATHAN REINGOLD, *Acting Archivist*

The Smithsonian Institution functioned as a central scientific agency in the United States until World War I, and its Secretaries consciously endeavored to make the Institution serve as a clearinghouse for scientific information. Thus, the official correspondence constitutes a valuable primary source for the history of science in the United States and Europe.

Although the 1865 fire in the Smithsonian Institution building destroyed the early Secretarial correspondence, the Archives possesses invaluable records of scientific development in this country and abroad. The official correspondence of the latter part of the 19th century and the early part of this century, including many letters to and from the world's leading scientists, is supplemented by the private correspondence of several of the Smithsonian's early Secretaries as well as notes, fieldbooks, and correspondence of many of the eminent scientists who have worked for the Smithsonian. These papers comprise a wealth of unique source material for the historian of science.

To make this material more easily accessible to scholars, both on the Smithsonian staff and from other institutions, the Archives staff is now engaged in an extensive program of reorganization of the material presently in its keeping and is also surveying and describing manuscript material located in other branches of the Smithsonian, thereby enhancing the usefulness of these manuscripts and preparing some of them for eventual incorporation into the Archives proper.

Material of particular interest in the official correspondence includes papers concerning numerous surveys of the West and other expeditions, records of the Smithsonian Astrophysical Observatory, manuscripts and records of Samuel P. Langley's early experiments in flight, and a collection of papers and correspondence between the Smithsonian and Robert H. Goddard concerning its support of his early work on rockets.

There is also material on various projects once connected with the Smithsonian, such as records of early meteorological studies and correspondence relating to the foundation of the Carnegie Institution, the establishment of NACA (which became NASA), and the early years of the Fish Commission. Among the collections are the field notebooks, laboratory notes and correspondence of many nineteenth-century natural scientists who either worked for the Smithsonian or who gave their collections to the National Museum, such as S. F. Bird, William Healey Dall, G. Brown Goode, Fielding B. Meek, W. H. Holmes, and Robert Ridgway.

Several collections date from periods prior to the establishment of the Smithsonian Institution: some papers of Alexander Dallas Bache, including his early geomagnetic research, the records and correspondence of the Columbian Institute and the National Institute, and material on the Wilkes Expedition among others.

The Smithsonian Archives also has a fine collection of photographs and prints of scientists.

The Archives welcomes all qualified scholars in the history of science who are undertaking research on American participation in science in the ninteenth century and its relationship to European science. The staff offers visiting scholars assistance in research in the materials in the Archives and can refer them to other sources of information elsewhere in the Smithsonian.

ADDITIONAL SMITHSONIAN STAFF WITH INTERESTS RELATED TO HISTORY OF SCIENCE AND TECHNOLOGY

JOHN M. ELLIOTT, Museum Specialist, National Armed Forces Museum Advisory Board. Specialty: U.S. naval and Marine Corps history; aeronautics. Full listing under "Program in Museum Studies."

JOHN C. EWERS, Senior Ethnologist, Department of Anthropology and Member, Center for the Study of Man. Specialty: ethnology of the American Indians. Full listing under "Program in Anthropology."

O. J. GINGERICH, Physicist; Associate Director, Central Bureau for Astronomical Telegrams; Professor of Astronomy and the History of Science, Harvard University. 1951: B.A., Goshen; 1953: M.A., Harvard; 1962: Ph.D., Harvard; 1955–1958: Director, American University Observatory, Beirut. Specialties: theoretical and numerical models of stellar atmospheres, especially the interpretation of ultraviolet spectra, and the history of astronomy. Currently completing analyses of the theoretical basis for spectral classification of A0–K0 stars and also for cool stars with surface temperatures around 2500°K; extensively studying Kepler's *Astronomia Nova* and preparing the first English translation; examining, with computer help, various early ephemerides to determine the internal consistency of the calculations and their accuracy for predicting planetary positions. Book: with W. Stahlman, *Solar and Planetary Longitudes from –2500 to ±2000* (1963). Articles: "Review of Opacity Calculations," *SAO Special Rpt. 167* (1964); "Eleven-Digit Regular Sexagesimals and Their Reciprocals," *Trans. Amer. Phil. Soc.* (1965); "Blanketing Approximations for Solar Models," *Journ. Quant. Spectrosc. Radiat. Transfer* (1966); with S. E. Strom and K. M. Strom, "Studies in Non-Gray Stellar

Atmospheres. III. The Metal Abundances of Sirius and Vega," *Astrophys. Journ.* (1966); with C. de Jager, "The Bilderberg Model of the Photosphere and Low Chromosphere," *Solar Phys.* (1967).

CRADDOCK R. GOINS, Jr., Associate Curator, Division of Military History. Specialty: evolution of firearms. Full listing under "Program in American Studies."

EDGAR M. HOWELL, Curator, Division of Military History. Specialties: military history, especially uniforms, headgear, footwear, insignia; military graphics, especially original artwork relating to the Army role in opening and developing the West. See full listing under "Program in American Studies."

HAROLD D. LANGLEY, Associate Curator, Division of Naval History. Specialty: United States naval, diplomatic and social history. Full listing under "Program in American Studies."

PHILIP K. LUNDEBERG, Curator, Division of Naval History. Specialties: history of commerce warfare and undersea warfare; strategic, tactical, and technological aspects of undersea warfare, especially German U-boat warfare and U.S. and British antisubmarine warfare; history of American naval architecture. Full listing under "Program in American Studies."

MENDEL L. PETERSON, Curator, Division of Historic Archaeology and Director, Underwater Exploration Project. Specialty: exploration of underwater shipwreck sites. Full listing under "Program in American Studies."

WILLIAM C. STURTEVANT, Curator, Division of North American Anthropology and Member, Center for the Study of Man. Specialties: ethnology, with area emphasis on eastern North America, Burma, and 16th century West Indies, and topical emphasis on ethnohistory, ethnoscience, linguistics, ethnobotany, and material culture. Full listing under "Program in Anthropology."

AMERICAN STUDIES

INTRODUCTION

Research in subject areas dealing with cultural, civil, political, and military history as they depict patterns of American civilization is the basic concern of American studies at the Smithsonian. Historical conjunctions of various aspects of our civilization are to be found in major collections of American art, material culture, political memorabilia, portraiture, and other documents—their significance can be successfully communicated through an institutionalization of rapport between objects and scholars. A special effort has been made to provide a link between the various Smithsonian research capabilities in this subject area and university graduate programs in American history and related fields. Cooperative programs with local universities as well as those more distant from Washington provide a continuing student group, which also includes students pursuing dissertation research supervised and directed by members of the Institution's professional staff.

In the field of American Studies it is expected that the Office of Academic Programs will be able to offer a total of 12 Visiting Research Appointments in its programs of higher education and research training of which full stipends may be awarded to three Visiting Postdoctoral Research Associates and three Visiting Research Associates (Ph. D. candidates).

In addition to the research staff listed below, other staff members with related interests will be found at the end of this section on American Studies.

AMERICAN STUDIES PROGRAM

Recognizing the diverse and extensive character of the Institution's research and reference resources relating to American civilization, a special staff has been set up to explore Institution-wide perspectives in American Studies. These perspectives are identified and formulated by the American Studies Program staff in terms of offerings of formal instruction on a graduate level. Courses, including an orientation seminar in "The Material Aspects of American Civilization", are conducted annually utilizing Smithsonian resources. Formal instruction and directed research are also provided by the American Studies Program in other areas of Smithsonian interest such as industrial and historical archeology, and urban studies. Course offerings and staff supervised research are available to graduate students from cooperating universities and to individuals upon acceptance by the American Studies Program. Inquiries concerning program content should be made to the Director, American Studies Program, Room 309, National Portrait Gallery, Smithsonian Institution, Washington, D. C. 20560. Universities and other educational institutions desiring information on administrative arrangements for institutional cooperation should contact the Director of the Smithsonian's Office of Academic Programs.

Research Staff

WILCOMB E. WASHBURN, Chairman; Adjunct Professor of History, American University, Consultant in Research to the Graduate School of Arts and Sciences, George Washington University, Lecturer in American Studies, University of Maryland; 1948: B.A., Dartmouth; 1951: M.A., Harvard; 1955: Ph.D., Harvard; 1955–1958: Fellow, Institute of Early American History and Culture, Williamsburg; 1958–1965: Curator, Division of Political History, Smithsonian. Specialties: European expansion in the Age of Discovery, American colonial and political history, American Indian and white relations, American museum history; current research on the history of the American colonies in the 17th century, and a book on the American Indian. Books: *The Governor and the Rebel: A History of Bacon's Rebellion in Virginia* (1957); ed., *The Indian and the White Man* (1964). Articles: "The Meaning of Discovery in the Fifteenth and Sixteenth Centuries," *Am. Hist. Rev.* (1962); "The Great Autumnal Madness: Political Symbolism in Mid-Nineteenth Century America," *Quarterly Journ. Speech* (1963); "Manuscripts and Manufacts," *Am. Archivist* (1964); "Law and Authority in Colonial Virginia" in *Law and Authority in Colonial America* (1965); "The Museum and Joseph Henry," *Curator* (1965); "The Age of Discovery" in *Service Center for Teachers of Hist.* publ. no. 63 (1966); "The Influence of the Smithsonian on Intellectual Life in Mid-Nineteenth Century Washington," *Rec. Columbia Hist. Soc. Wash., D.C., 1963–1965* (1966); "The Intellectual Assumptions and Consequences of Geographical Exploration in the Pacific" in Herman R. Friis, ed., *The Pacific Basin: A History of Its Geographical Exploration* (1967); Joseph Henry's Conception of the Purpose of the Smithsonian" in Walter Muir Whitehill, ed., *A Cabinet of Curiosities: Five Episodes in the Evolution of American Museums* (1967); "Philanthropy and the American Indian: The Need for a Model," *Ethnohistory* (1968); "Are Museums Necessary?," *Museum News* (1968); "Speech Communication and Politics," *Today's Speech, (1968);* "Examen Critique des Questions Cartographiques dans la Decouverte," *La Decouverte de L'Amerique* (1968); "Temple of the Arts: The Renovation of Washington's Patent Office Building," *AIA Journal* (1969). Speaks French, Spanish.

RICHARD H. HOWLAND, Special Assistant to the Secretary: special advisor on architecture and historic preservation. 1931: B.A., Brown; 1933: M.A., Harvard; 1946: Ph.D., Johns Hopkins; 1946–1956: Chairman, Department of Art History, Johns Hopkins; 1956–1960: President, National Trust for Historic Preservation. Specialties: architectural history, classical archeology; current research on architectural history, collecting architectural archival material. Fieldwork: Greece, Ethiopia. Books: *Greek Lamps and Their Survivals* (1953); with E. Spencer, *The Architecture of Baltimore* (1955); chapter 8 of *With Heritage So Rich* (1966). Articles: "The Society of Architectural Historians," *Rpt. Comm. on Hum.*, Am. Council Learned Soc. (1964); "What Is Past Is Prologue," *Mus. News* (1964). Speaks modern Greek, French, German.

HAROLD K. SKRAMSTAD, Jr., Specialist in American Studies; 1963: A.B., The George Washington University; 1969: M.Ph., The George Washington University; 1966–1967: Instructor, The George Washington University; 1967–1968: Fellow in Material Culture, The George Washington University; 1968–1969: Associate in American Studies, Smithsonian. Specialities: social relations of American technology; material aspects of American culture, museum related educational programs; current research on cultural context of American technology and iconography of Washington, D.C., biographical studies of American civil engineers.

NATIONAL MUSEUM OF HISTORY AND TECHNOLOGY

DANIEL J. BOORSTIN, *Director*

Opened to the public in January 1964, the National Museum of History and Technology is equipped to accommodate exhibition halls, work rooms, research collections, libraries, and laboratories. The research facilities are in full operation, and some two dozen of the exhibition halls are now open.

In this book the Museum is treated as part of two categories: American Studies and the History of Science and Technology. The emphasis of the collections is American, but many of them, especially those in science and technology, are worldwide in interest and content. The Museum's large collections provide opportunities for research in all aspects of American civil and military history and the history of science, technology, and arts and manufactures.

The museum historian does not limit his research to written source materials in reconstructing and interpreting history but seeks history in objects as well as in words. In field and laboratory he employs the tools and methods of modern technology to obtain a more precise understanding of how people lived in the past. He consults a greater variety of sources than does the academic historian. In the Museum of History and Technology he finds an opportunity to read history not only in letters and documents but also in illustrated trade catalogs, magazine and newspaper advertisements, plans, drawings, paintings, prints, and photographs, and in three-dimensional objects. He can concern himself with the broader implications of objects–the roles they played in the cultures which produced them and the social implications of technological change.

Important collections of objects in each of the seventeen divisions of the Museum, supplemented with archival collections of significance, form the basic facilities for research in material American culture, as well as in all aspects of American history as related to world history and the general history of science and technology.

The most challenging opportunities exist to pursue studies in the historical conjunctions of science, technology, material culture, and the decorative arts. The Smithsonian offers these opportunities at the center of Government archives and research libraries and institutions. Its own archives comprise a noteworthy source of material for studies of nineteenth-century relations of science and government.

Library

The library of the Museum is a research library with collections in cultural and military history, history of science and technology, history of manufactures, and history of the graphic arts. The trade literature collection (more than 225,000 volumes) provides invaluable material for the study of economic history, modern technology, and the history of manufactures. Other special collections include the George H. Clark collection on the history of radio and allied industries. The philatelic collection is perhaps the largest on philately and postal history to be found in the United States.

The National Museum of History and Technology is one of the foremo research institutions for the study of the American past and its relation to th present, as is demonstrated in the descriptions of its collections and programs.

COLLECTIONS AND RESEARCH SPECIALTIES

ARMED FORCES HISTORY

Underwater Exploration

The underwater exploration program in the collections of armed forces history is concerned with the investigation of historic underwater sites in the western hemisphere, particularly those related to shipping along the great treasure route from the Caribbean to Europe, underwater sites of American naval vessels in salt water, and sites of a similar nature in the lakes and rivers of the United States. The objective of the program is the collection and study of significant artifacts from these sites, the measurement and photographing of remains of ships, and research on documents and other related materials in the archives of the United States and Europe relevant to underwater exploration.

Underwater exploration in the western hemisphere has evolved from mere treasure hunting to systematic underwater archeology. In the solution of historical problems it combines with field exploration of underwater sites the study of written records of shipping and shipwrecks and of the manufacture and uses of artifacts. It results in the recovery, preservation, and identification of dated artifacts which help to document the progress of the introduction of European culture into the New World, routes and cargoes in colonial trade, and the development of ships and of their armament and other equipment.

Specific areas of research include the techniques of surveying, measuring, and recording undersea remains. For example, three new instruments for measuring in plan and elevation were used recently in the exploration of the timber remains of a ship believed to be Spanish and of the late sixteenth century: an ingenious camera stand for photographing the remains in plan and two instruments for measuring remains in elevation.

The program includes laboratory investigation of methods of preservation of organic materials recovered from underwater sites and the development of new processes for their preservation. Among the preservation methods being studied are a more rapid method for dehydrating organic materials and the use of preservatives that penetrate and strengthen wood specimens.

The collections and the methods of restoring and preserving them offer numerous opportunities for research and the preparation of theses in a number of fields.

Military History

Research in the division of military history is concerned with the material aspects of American military history. It involves investigations in firearms, edge weapons, heavy ordnance (including ammunition), military dress and equipment (including headgear and footwear), military heraldry in all its various facets, and military graphics. The collections of the division are unusually rich in all these categories.

In the weapons collections, which include a wide selection of developmental models and patent models, the researcher may study the development of the firearm from its most primitive state to its most modern. The edge weapon and cartridge collections also provide comprehensive materials for developmental studies.

The uniform collection is the largest single grouping of American regular army dress in existence and includes a large number of Quartermaster Department sealed samples. In addition, there is a large collection of European uniforms available for comparative study. Several staff members are engaged in compiling a comprehensive descriptive and critical catalog on United States army dress, including uniforms, headgear, and footwear.

In the fields of military heraldry, including insignia, flags, medals, decorations, and orders, and of military graphics the division also provides extensive research possibilities.

As an active member of the Congress of Museum of Arms and Military Equipment, an international research organization, the Division participates in many of the Congress' projects. The division also conducts historic excavations on early fort and cantonment sites as part of its program of research in early military construction and fortification and early military garrison life.

Naval History

Research on the history of naval operations and administration, architecture, ordnance, and other aspects of naval technology is conducted by the division of naval history. Through systematic expansion of its reference collections in these fields, the division seeks to provide comprehensive documentation for existing and contemplated models and to afford authoritative guidance for students of material and intellectual aspects of American naval history. In connection with the forthcoming bicentennial of the American Revolution, a survey of promising underwater sites of warships and privateer wrecks is currently being undertaken. In interpreting major themes of U.S. naval history, the division has sought to expand its biographical, uniform, and weapons collections related to squadron, amphibious, and commerce warfare; privateering; naval administration; naval exploration; and notable examples of naval diplomacy. In cooperation with the Naval Historical Foundation, the American Military Institute, and the Smithsonian Associates, the division annually sponsors lectures covering a broad range of naval and maritime history.

The division recently coordinated the participation of American scholars in a *Bibliography of the History of the Great Sea Routes,* under the sponsorship of the International Commission of Maritime History. Close cooperation with the Division of transportation has produced a joint program in maritime history and technology, for which research proposals are particularly invited during the academic year 1970–1971.

This section maintains and is steadily expanding the most comprehensive collection of United States warship plans and models in existence, including nearly 100 rigged models and 150 original builders' half-models, ranging from the 24-gun ship *Boston* (1748) to the nuclear, guided missile frigate *Bainbridge* (1962). The half-model collection, on indefinite loan from the Department of the Navy, constitutes a major national treasure, being a primary source of information on the American sailing navy and the early steam navy. Specialized equipment is available for taking hull lines off these and other half-models, which in some instances represent the only remaining primary record of the design of historic American naval vessels. Staff members are currently preparing a series of catalogs of these ship model collections.

Extensive collections of equipment associated with the Hall, Peary, and Byrd expeditions are available for students of polar discovery. The Weems Memorial Library, including a major collection of navigation instruments and specialized publications, provides basic data on the development of modern celestial navigation in the United States. The Simon P. Fullinwider and Ralph C. Browne collections include significant material relating to the development of the North Sea Mine Barrage during World War I.

CIVIL HISTORY

Collections

As its major areas of emphasis in the programs of research and curating of collections, civil history is composed of several divisions; cultural history, musical instruments, numismatics, philately and postal history, political history, and growth of the United States, as well as a historic American costume section under the office of the chairman. Its collections comprise its chief facilities for research, among them the Harry T. Peters "America on Stone" Lithography Collections, comprising 2,000 non-Currier and Ives prints dating between 1818 and 1900. The collection offers the opportunity for study of the visual aspects of change in the 19th century, as well as the ideas, attitudes, and values of nineteenth-century America. The Peters Collection, in addition, provides the possibility for study in depth of the work of many important but little known lithographic artists and publishers.

Other research facilities include collections of objects expressing the material culture of the United States, with strong emphasis on domestic utensils, folk pottery, lighting devices, and Victorian furnishings; examples of colonial and post-colonial architecture and interior furnishings in the forms of period rooms and colonial houses; furniture and decorative objects, with emphasis on rural and folk sources; and a collection of artifacts from historical sites, mostly east-coast United States. Among the varied and outstanding collections of American folk art are the Eleanor and Mabel Van Alstyne Collection and the Joel Barlow Collection. This division has an archeological laboratory equipped to process artifacts which are acquired in the course of historic archeology; it has all the requisite mechanical and chemical equipment, such as ovens for drying, distilled water filters, a tank for electrolytic processing of iron, etc.

A collection of musical instruments from Europe and America, including one of the world's largest collections of keyboard instruments, offers considerable opportunity for research in this field. A well-equipped conservation laboratory has facilities for restoration of most types of instruments, for study of instrument-making techniques and the construction of reproductions. An increasing number of instruments, including Flemish, English, and Italian harpsichords, have been restored to playing condition. They are available to qualified researchers and are used in performances sponsored by the Museum, as well as for studies of performance conventions. Also, maintained in the division's reference library, are a growing iconographic file, including some 1,500 entries, and the Hugo Worch Collection of 2,115 photographs of keyboard instruments, and advertisements.

Collections in the political history of the United States include political campaign memorabilia, which provide opportunities for the study of the techniques of presidential campaigning, the use of political symbols, the development of campaign devices, and the history of campaign music; collections of objects which have an association with historic Americans, especially Presidents, cabinet members, and other Government departmental heads, including clothing and funeral memorabilia; and collections concerning the past Secretaries of the Smithsonian Institution. The collection of memorabilia of the Presidents and other notable Americans offers opportunities for research on the personal interests and accomplishments of these public figures. Other collections of growing significance concern objects and papers associated with the campaign for women's rights and other social reform movements. White House history is documented by dresses and personal belongings of the First Ladies and by White House china and furnishings.

Material for research in all phases of philately and postal history includes a general collection of postage stamps of the world and special, highly concentrated collections of the postage stamps of Afghanistan, Chile, Ecuador, Indian states, Israel/Palestine, Japan, Latvia, Paraguay, Peru, Russia (local issues), Spain, Switzerland (military stamps), and the Ukraine; postal stationery of the world especially important for U.S. issues and those of the nineteenth-century German states; U.S. postage stamps, certified plate proofs, and revenue stamps; U.S. pre-stamp covers; Emma E. Batchelor airmail collection of the world and mail carried by Zeppelin posts; U.S. postage meter machines and postal markings; and Papal States pre-stamp covers—a total of over ten million objects. Library materials consist of the best accumulation in the United State of certain types of philatelic and postal-history publications.

The general numismatic collections provide good opportunities for research in many fields. Some portions are authoritative and afford excellent study possibilities: for instance, the 18th-and 19th-century Russian coins and medals which are paralleled only by the collections available in the Union of Soviet Socialist Republics. The 19th-century collections of paper currencies and various forms of scrip of the Austro-Hungarian Empire extend into the period of World War I, and these constitute a valuable reference for the student in economic history, as do many other series of paper currencies and documents of value which are well represented in the national numismatic collections. Another significant series is a large collection of ancient coins from Asia Minor.

The Herbert Bratter files on inflationary developments from 1932 to 1959 have been added recently. These files contain a considerable amount of material concerned with "The Committee for the Nation" and form an interesting case history in monetary propaganda.

The division of the growth of the United States is concerned with the evolution of American society from the Age of Exploration through the very recent past. The end result of this project will be seen in five museum halls: Hall I, pre-1640; Hall II, 1640 to 1750; Hall III, 1750 to 1851; Hall IV, 1851 to 1945; and Hall V, 1945 to the present. Within these subdivisions three hundred years of American experience will be interpreted; thus, a person standing in Hall III will, for example, see only the objects of that century (mid-18th to mid-19th) presented to emphasize all aspects of American life and accomplishment: art, literature, science, technology, religion, education, law, government.

In each of the halls the same pattern will be followed with surviving objects and ideas from each century combined to give the visitor a synopsis of the richness of the American tradition as well as an index to all of the specialized halls within the new Museum of History and Technology.

The research and writing necessary for the production and installation of these halls comprise the work of the division of the growth of the United States. States.

Research Staff

RICHARD E. AHLBORN, Curator, Division of Ethnic and Western Cultural History. 1956: B.F.A., Colorado; 1958: M.A. Delaware; 1959–1960: Yale; 1960–1961: Research Fellow, Museum of International Folk Art, Santa Fe; 1961–1965: Curator, Joslyn Art Museum, Omaha; 1965–1969: Associate Curator, Division of Cultural History, Smithsonian. Specialty: Spanish colonial art in the U.S. Mexico, and the Philippines; currently analyzing sculptures of San Xavier del Bac, Tucson. Books: editor and contributor, *Three Centuries of Peruvian Silver* (1967); *The Penitente Moradas of Abiquiu* (1968). Articles: "The Ecclesiastic Silver of Colonial Mexico," and "Domestic Silver in Colonial Mexico," *1968 Winterthur Conference Report: Spanish, French and English Traditions in The Colonial Silver of North America* (1968).

SILVIO A. BEDINI, Assistant Director. 1935–1942: Columbia University. Specialty: history of scientific instruments and the mathematical practitioner; current research on the history of early American scientific instruments and the mathematical practitioner, history of horology, scientific instrumentation in 14th- through 17th-century Italy. Fieldwork: European museums and archives. Books: *The Scent of Time* (1963); *Early American Scientific Instruments and Their Makers* (1964); with Francis R. Madison, *Mechanical Universe* (1966); *The Sign of the Quadrant* (in press). Articles: "The Instruments of Galileo Galilei," *Man of Science* (1967); "Galileo Galilei and the Measure of Time," *Saggi su Galileo Galilei* (1967); "The 17th Century Table Clepsydra," *Physis* (1968). Speaks French, Italian.

DANIEL J. BOORSTIN, Director. 1934: B.A., Harvard; 1936: B.A. (Jurisprudence), Balliol College, Oxford; 1940: S.J.D., Yale; 1968, Litt. D., Cambridge University, 1938–1942; Instructor, Harvard College and Harvard Law School; 1942–1944: Instructor, Swarthmore College; 1944–1969: faculty appointments, Preston and Sterling Morton Distinguished Service Professor of American History, University of Chicago; 1950–1951: visiting professor of American History at the University of Rome; 1953: consultant to Social Science Research Center at the University of Puerto Rico; 1957: visiting professor of American History at the University of Kyoto, Japan, and lecture tour in Korea; 1959–1960: lecture tour for United States State Department in Turkey, Iran, Nepal, India, and Ceylon; 1961–1962: first incumbent of chair of American history at the Sorbonne (University of Paris); 1964–1965: Pitt Professor of American History and Institutions, Cambridge University and Fellow of Trinity College, Cambridge; 1968: lecture tour for the State Department in Indonesia, Australia, New Zealand, and Fiji. Books: *The Americans: The Colonial Experience* (1958); *The Americans: The National Experience* (1965); *The Image: A Guide to Pseudo-Events in America* (1964); *The Genius of American Politics* (1953); *America and the Image of Europe* (1960); *The Lost World of Thomas Jefferson* (1960); *The Mysterious Science of the Law* (1958); editor, *Chicago History of American Civilization and An American Primer* (1966). 1967-present: Member, American Revolution Bicentennial Commission.

MRS. ELVIRA ELIZA CLAIN-STEFANELLI, Curator, Division of Numismatics. 1938: M.A., Cernauti, Rumania; 1940–1942: Fellow, Rumanian Academy, Rome; 1947–1956: Free-lance writer, Rome, Italy, and New York City. Specialties: history of money and medallic art (particularly ancient Greek coins from Sicily and South Italy), modern gold coins, and the art of the medal. Field coins, and the art of the medal. Fieldwork: Archives and numismatic collections in museums in Rome, Naples, Milan, Turin, Gotha, Dresden, Munich, Berlin, Prague, Vienna, Madrid, Stockholm, Copenhagen, London, Cambridge, Oxford (1941–1967). Current research on Latin American gold coins, numismatic bibliography, coins of ancient Greek Messana. Books: *Russian Gold Coins* (1962); *Select Numismatic Bibliography* (1965); chapter "Etats-Unis," *Exposition internationale de la medaille actuelle* (1967); chapter "The United States, Canada, Central and South America," vol. III *A Survey of Numismatic Research, 1960–1965* (1967). Articles: Gold Coins of the 19th and 20th Centuries," *Canadian Num. Journ.* (1959); "Numismatics–An Ancient Science, a Survey of Its History," *Cont. from the Mus. of Hist. and Tech.* (1965); "Italian Coin Engravers since 1800," *Cont. from the Mus. of Hist. and Tech.* (1965); "The United States, Canada, Central and South America," *A Survey of Numismatic Research 1960–1965* (1967); "Etats-Unis," *Exposition Internationale de la Medaille Actuelle* (1967); "L'evolution artistique de la medaille aux Etats Unis," *Medailles* (1968). Speaks German, French, Italian, Rumanian.

VLADIMIR CLAIN-STEFANELLI, Curator, Division of Numismatics. 1936: M.A., Cernauti-Czernowitz, Rumania; 1938: Ph.D., Cernauti-Czernowitz; 1939–1940: Fellow, Rumanian Academy, Rome; 1937–1938: Museum Assistant, Museul Regele Carol II (formerly Bukowiner Landesmuseum), Cernauti-Czernowitz; 1939: in charge of Greek coin corpus, Prussian Academy of Sciences. Specialties: coinages of the Greek colonies on the western Black Sea coast, 15th-and 16th-century southern European issues, historical documentation of U.S. coinages, history of money and medallic art; current studies on application of scientific methods of research in numismatics, such as X-ray diffraction using back-reflection techniques as nondestructive method for distinguishing between struck (authentic) and cast (false) coins. Fieldwork: public and private collections throughout the world. Books: sections of *Ex Nummis Historia*–"Reges Macedoniae," "Alexandri Magni Succesores" in vol. I–*Greek Coins* (1949), all vol. II–*Aes Grave* (1949), all vol. III–*Coins of Trajan, Hadrian, and Their Families* (1950), all vol. IV–*Roman Coins from Antoninus Pius to the Fall of the Western Empire* (1951). Articles: "Genuine or False? The Application of X-ray Fluorescence Analysis in the Authentication of Coins," *The M.A.N.A. Journ.* (1963); "A New Quarter Shekel of the First Year of the Jewish War," *Israel Num. Journ.* (1964); "The Future of the United States Coinage," *The Numismatist* (1964); "Money," *The World Book Enc.* (1965); "Historical Notes on Coinage Metals," *(1965); "Monetary History and Medallic Art at the Smithsonian Institution,"* *Numisma* (1965); "Birds on Coins," *Birds in Our Lives* (1966); "Numismatics Re-Examined," *The Canadian Num. Journ.* (1967); "History of the National Numismatic Collections," *Cont. from the Mus. of Hist. and Tech.* (1968). Speaks German, French, Italian, Rumanian.

HERBERT R. COLLINS, Assistant Curator, Division of Political History. 1954: B.S., Richmond Professional Institute, William and Mary; 1958–1962: American; 1960: graduate, 10th Institute of Genealogical Research, National Archives. Specialties: genealogical research, Virginia state and local history, American history and political science, presidential history; current research on presidential memorabilia, White House transportation, presidential campaign objects, historic Americans. Books: *History and Genealogy of the Collins Family* (1954); *The Todds of Virginia* (1960). Articles: "Political Campaign Torches," *Cont. from the Mus. of Hist. and Tech.* (1964); "Red Cross Ambulance of 1898," *Cont. from the Mus. of Hist. and Tech.* (1965); "Original Panels from Jackson's Phaeton Found," *The Carriage Journ.* (1965); "White House Stables and Garages," *Rec. of the Columbia Hist. Soc. (1966).*

MRS. GRACE ROGERS COOPER, Curator, Division of Textiles; Senior Technical Editor, Textiles, *Encyclopaedia Britannica.* 1946: B.S., Maryland. Specialties: textile implements and machines, textiles made or used in the United States, preservation (conservation) of antique fabrics; current research on spinning wheels and printed fabrics in America. Books: *Scholfield Wool-Carding Machine* (1959); *Invention of the Sewing Machine* (1968). Articles: "Textiles and Textile Machines," *Tech. and Culture* (1961); "Origin and Development of the Loom," *Enc. Brit.* (1967). Absence: Sabbatical in calendar year 1970.

JOHN T. FESPERMAN, Associate Curator-in-Charge, Division of Musical Instruments, 1948: B.S., Davidson; 1951: B.Mus., Yale; 1956: Amsterdamsche Conservatorium; 1960: M.Mus., New England Conservatory; 1959–1965: Faculty Member, New England Conservatory; 1960–1965: Director of Music, Old North Church. Specialty: 17th–and 18th–century keyboard music and keyboard instruments, especially organs. Fieldwork: early 18th–century organs in northern Europe. Books: *The Organ as a Musical Medium* (1960); *Checklist of Keyboard Instruments at the Smithsonian* (1967). Articles: "Rhythmic Alterations in 18th–Century French Keyboard Music," *Organ Inst. Quarterly* (1966); "Music and Organs at the Old North," *Organ Inst. Quarterly* (1966); Music for Small Organ," *Journ. of Church Music;* (1966); "Report from Washington," *Current Musicology* (1968). Speaks Dutch.

PAUL V. GARDNER, Curator–in–Charge, Division of Ceramics and Glass. 1930: B.S., Alfred; 1947: University of Miami; 1919–1931: Designer and Assistant to the Manager, Steuben Division, Corning Glass Works; 1931–1943: Assistant to the Art Director and Designer, Corning Glass Works. Specialties: Carder Steuben glass of the period 1903–1932, American and European glass of the 18th, 19th and 20th centuries, European porcelain of the 18th and 19th centuries, ancient glass from 1500 B.C. to 1200 A.D.; current research on 18th–century European porcelain, also writing a technical biography of Frederick Carder (1863–1963). Books: *Meissen and Other German Porcelain in the . . . Pell Collection* (1956, 1966); *Glass from Private American Collections and the Smithsonian Institution* (1962). Articles: "Earthenware," "Chinaware," *Enc. Brit.* (1964); "Great Glass at the Smithsonian," *Antiques* (1964); "Eighteenth–Century Porcelain at the Smithsonian," *Antiques* (1965).

CRADDOCK R. GOINS, Jr., Associate Curator, Division of Military History. 1954: B.S., Georgetown. Specialty: evolution of firearms; current research on development of breechloading firearms in the first half of the 19th century. Articles: "John H. Hall and Hall Breachloading Firearms," "Edward Maynard," "Pump Actions," "Repeating Arms," "Lorenzoni Repeating Systems," *Encyclopedia of Firearms* (1964).

MRS. ANNE CASTRODALE GOLOVIN, Associate Curator, Division of Pre-industrial History. 1960: B.A., Pennsylvania State; 1962: M.A., Delaware. Specialty: American decorative arts of the 18th and 19th centuries. Article: "William Wood Thackara, Volunteer in the War of 1812," *Penn. Mag. of Hist. and Biog.* (1967).

MRS. CYNTHIA A. HOOVER, Associate Curator, Division of Musical Instruments. 1957: B.A., Wellesley; 1958: M.A.T., Radcliffe; 1961: M.F.A. Brandeis; 1958–1960: Teaching Assistant, Wellesley College. Specialty: musical instruments made and used in America; current research on musical instruments in 18th-and 19th-century America. Article: "The Slide Trumpet in the Nineteenth Century" (1963); "A Trumpet Battle at Niblo's Pleasure Garden," *Musical Quarterly* (1969).

EDGAR M. HOWELL, Curator, Division of Military History. 1938: B.A., Princeton; 1949–1956: Historian, Office, Chief of Military History, Department of the Army; 1954–1956: Chief, Organizational History and Honors Branch, Department of the Army. Specialties: military history, especially uniforms, headgear, footwear, insignia, and military graphics, especially original artwork relating to the Army role in opening and developing the West; current research on uniforms, headgear, Western graphics. Fieldwork: Sackets Harbor, N.Y.; Fort Adams, Miss. Books: *The Soviet Partisan Movement, 1941–1944* (1956); ed., *Uniform Regulations for the Army of the United States, 1861* (1961); with J. Duncan Campbell, *American Military Insignia, 1800–1851* (1963); with Donald E. Kloster, *United States Army Headgear to 1854* (1969). Articles: "A Special Artist in the Indian Wars–Theodore R. Davis and the Hancock Campaign of 1867," *Montana, the Mag. of West. Hist.* (1965); "Harvey Dunn: The Searching Artist Who Came Home to His First Horizon," *Montana, The Mag. of West. Hist.* (1966); "An Artist Goes to War: Harvey Dunn and the A.E.F. War Art Program," *Smithsonian Journal of History* (1968).

MRS. CLAUDIA B. KIDWELL, Assistant Curator. 1962: B.S., Maryland; 1964: M.S., Pennsylvania State. Specialty: women's dress and accessories of dress; current research on means of production and distribution of women's dresses during the 18th and 19th centuries. Article: "Women's Bathing and Swimming Costume in the United States," *U.S.N.M. Bulletin 250* (1968).

MRS. MARGARET B. KLAPTHOR, Associate Curator, Division of Political History. 1943: B.A., Maryland. Specialties: history of the First Ladies, White House history, Smithsonian collections of objects relating to George Washington and the Adams family, Maryland state and local history. Books: *Dresses of the First Ladies of the White House* (1952); *The History of Charles County (Maryland)* (1958); ed., historical text, *The First Ladies' Cook Book: Favorite Recipes of All the Presidents of the United States* (1965); *Maryland's Presidential First Ladies* (1967). Articles: "Presentation Pieces in the Museum of History and Technology," *Cont. from the Mus. of Hist. and Tech.* (1965); "Benjamin Latrobe and Dolley Madison Decorate the White House, 1809–1811," *Cont. from the Mus. of Hist. and Tech.* (1965); "White House China of the Lincoln Administration," *Cont. from the Mus. of Hist. and Tech.* (1967). Not in residence–Fall 1970.

HAROLD D. LANGLEY, Associate Curator, Division of Naval History. 1950: A.B. History, Catholic University; 1951: M.A. History, University of Pennsylvania; 1959: Studies with the Foreign Service Institute, Department of State; 1969: Ph.D. History, University of Pennsylvania. Faculty title: Professor of History, Catholic University of America. 1955–1957: Instructor and Assistant Professor, Marywood College; 1957–1964: Diplomatic Historian, Department of State, Washington, D.C.; 1964–1969: Associate and Professor of History, Catholic University of America. Specialty: United States naval, diplomatic, and social history. Current research on medicine in the United States Navy 1798–1899. Books: *Documents on International Aspects of the Exploration and Use of Outer Space* (1963); *Social Reform in the United States Navy* (1967); *St. Stephen Martyr Church and Community, 1867–1967* (1968). Articles: "An Early Proposal to Reorganize the Department of State," *Foreign Service Journal* (1968); "The Negro in the Navy and Merchant Service, 1789–1860," *Journal of Negro History* (1966); "Gideon Nye and the Formosa Annexation Scheme," *Pacific Historical Review* (1965); "Hunt for American Archives in the Soviet Union," *American Archivist* (1966).

PHILIP K. LUNDEBERG, Curator, Division of Naval History. 1944: B.A., Duke; 1947: M.A., Duke; 1954: Ph.D., Harvard; 1953–1955: Assistant Professor of History, St. Olaf College; 1955–1959: Assistant Professor of History, U.S. Naval Academy. Specialties: history of commerce warfare and undersea warfare; strategic, tactical, and technological aspects of undersea warfare, especially German U-boat warfare and U.S. and British antisubmarine warfare; history of American naval architecture. Currently completing and cataloging a national collection of U.S. warship models, and completing a monograph on the Continental gondola *Philadelphia.* Current research on naval history of American Revolution; undersea warfare prior to and during World War I, including technological and strategic aspects. Techniques: technique of taking ship lines off ship half models in naval history reference collections (in collaboration with Museum Specialist Howard P. Hoffman). Books: co-author, *Sea Power: A Naval History* (1960); *The Great Sea War* (1961); *Triumph in the Atlantic* (1964); chapter on U.S.S. *Constitution* in Joseph Jobe ed., *The Great Age of Sail* (1967). Articles: "German Naval Literature of World War II," *U.S. Nav. Inst. Proceedings* (1956); "The German Naval Critique of the U-boat Campaign, 1915–1917 " *Mil. Affairs* (1963); "The Continental Gunboat *Philadelphia* and the Northern Campaign of 1776" (1966); "Undersea Warfare and Allied Strategy in World War I," *Sm. Journ. of Hist.* (1967); "La Replique de la Duexieme Guerre Mondiale" (1968). Speaks French, German. On leave

KEITH E. MELDER, Associate Curator, Division of Political History; Consultant in Graduate Study, Graduate School of Arts and Sciences, George Washington University. 1954: B.A., Williams; 1958: M.A., Yale; 1964: Ph.D., Yale; 1958–1961: Instructor in Humanities and Social Studies, Case Institute of Technology; 1964–1966: Lecturer in American History, Catholic University of America. Specialties: American social reform movements, especially the 1830–1860, status of American women and movement for women's rights, the Negro in the U.S., 19th-century American political campaigning, the social history of American education; current research on the beginnings of the women's rights movement in the United States (1800–1850); the professionalization of school teaching in the United States, 1820–1860 and the material culture of American education. Books: *The Beginnings of the Women's Rights Movement in the United States, 1800–1850* (1965); *The American Parade of Politics, 1788–1960* (1967). Articles: "Bryan the Campaigner," *Cont. from the Mus. of Hist. and Tech.* (1965); "Angel of Mercy in Washington: Josephine Griffing and the Freedmen, 1863–1872," *Rec. of the Columbia Hist. Soc.* (1966); "Ladies Bountiful: Organized Women's Benevolence in Early 19th–century America," *N.Y. Hist.* (1967); "Forerunners of Freedom: The Grimke Sisters in Massachusetts, 1837–1838," *Essex Inst. Hist. Coll.* (1967). On leave through January 1970.

J. JEFFERSON MILLER II, Associate Curator, Division of Ceramics and Glass. 1950: B.A., Johns Hopkins; 1953: L.L.B., Maryland; 1962: M.A., Delaware; 1960–1962: Winterthur Museum. Specialties: 18th–and 19th–century English transfer-printed earthenware made for the American market, 18th–century European porcelain, classification of ceramics from archeological excavations at American historical sites; currently cataloging Hans Syz and Robert H. McCauley Collections. Fieldwork: Mackinaw City, Mich. Articles: "The Designs for the Washington Monument in Baltimore," *Journ. of the Soc. of Architectural Historians* (1964); "Transfer Printed English Earthenware for the American Market," *Apollo* (1965); "Early Meissen Tea Canisters," *Country Life* (1965); "The Larsen and McCauley Collections at the Smithsonian Institution," *Antiques* (1965); *Baltimore's Washington Monument,* visitor handbook, Peale Museum, Baltimore; "Unrecorded American Views on Two Liverpool–Type Earthenware Pitchers," *Winterthur Portfolio* (1968).

ROBERT P. MULTHAUF, Senior Scientific Scholar; Professorial Lecturer in the History of Science, George Washington. 1941: B.S., Iowa State; 1950: M.A., California, Berkeley; 1953: Ph.D., California, Berkeley; 1961: Teacher, University of Pennsylvania. Editor, *Isis.* Specialty: history of technology. Book: *The Origins of Chemistry* (1967).

MRS. ANNE W. MURRAY, Curator Emeritus, Division of Costume and Furnishings, Department of Cultural History. 1941–1944: Phillips Gallery; 1956–1967: Curator in Charge, American Costume Collection, Department of Civil History. Specialty: History of American costume (both dress and accessories); current research on dress worn in America in 18th and early 19th centuries, period of Revolution. Articles: "The Attitude of the Eagle," *Antiques* (1947); "The Sampler, First Record of Design," *The Am. Home* (1947); "The Campaign of 1848," *The Am. Collector* (1948); "A Short History of the Apron," *Antiques* (1961); "Seventeenth–and Eighteenth–Century Dress in America," *Enc. Brit. (1962);* "The Elegant Handkerchief," *Antiques* (1965); "Sunshades, Parasols, and Umbrellas," *Antiques* (1967).

REIDAR NORBY, Assistant Curator, Division of Postal History. 1936: graduate, Polytechnic Institute, London; 1936–1939: Oslo University. Specialty: Scandinavian and Central European philately and postal history; current research on 19th-century U.S.–European postal relations, method of production of classic Norwegian stamps, cataloging of postal stationery of the world. Instrumentation and techniques: the use of enlarged tracings and photo positives for determining types and variations of printings of postage stamps, can also be applied to detection of forgeries and counterfeits. Articles: "Norway–Coat of Arms Issue 1863–66: One Original Drawing for all Denominations," *Thirteenth Am. Philatelic Cong. Yearbook* (1964); "Scandinavian Stamp Lexicon," *Scand. Scribe* (1965, 1966, 1967); "The Smithsonian's Swedish Mail Box," *The Posthorn* (1967); "Norwegian 'Local' Stamps–on Madagascar," *The Posthorn* (1967). "An Answer to the Stamp Theft Problem," *The Posthorn* (1968); "Gummy Observations," *Scandinavian Scribe* (1968); "Counterfeit Overprints on Danish Newspaper Stamps," *Scandinavian Scribe* (1968); "Project Smithsonian," *The Posthorn* (1968); "Smithsonian's Role in Philately," *SPA Journal* (1969); "8 advance skillings–Letters from out of the Past, and What They Tell Us," *American Swedish Historical Foundation Yearbook 1968* (1969); "Glimpsing at Scandinavian History–Through Philatelic Peepholes," *Gibbons–Whitman Stamp Monthly* (1969). Speaks Danish, Norwegian, Swedish, German, French.

EUGENE OSTROFF, Supervisor, Division of Graphic Arts, and Curator of Photography. 1950: B.A., New York; 1955–1958: Graduate School of Engineering, Columbia; 1956–1960: Supervisor of Technical Services, Ilford, Inc. Specialties: preservation and restoration of photographs, history of photography; current research on early photographic and photomechanical processes; early photographic patents; the work of W.H.F. Talbot of England; preservation and restoration of photographs. Articles: "Early Fox Talbot Photographs and Restoration by Neutron Irradiation," *Journ. of Photo. Sci.* (1965); "Restoration of Photographs by Neutron Activation," *Science* (1966); "Talbot's Earliest Extant Print, June 20, 1835, Rediscovered," *Phot. Sci. and Eng.* (1966); "Preservation of Photographs," *Phot. Journ.* (1967); "Image Reproduction: Photography and Photomechanics," *The Photographic Journal* (1969).

MENDEL L. PETERSON, Curator, Division of Historic Archeology, Director, Underwater Exploration Project. 1938: B.S. Mississippi Southern; 1940: M.A. Vanderbilt; 1945–1947: Lowell Technical Institute; 1943–1948: explored Antarctica with Task Force 39, U.S. Navy. Specialties: exploration of underwater shipwreck sites. Fieldwork: Florida, Bermuda, Bahamas, Jamaica 1951–1969; current research on marking and decoration of muzzle-loading guns. Special technique: methods of underwater exploration. Books: *Preservation of Materials Recovered from Waters* (1965); *History under the Sea* (1965). Articles: "Ordnance Materials Recovered from an Early Sixteenth Century Wreck Site," *Journ. of the Co. of Mil. Collectors and Historians* (1961); "The Condition of Materials Found in Salt Water," *Diving into the Past*, St. Paul (1964); "The Spanish Plate Fleet," *Proceedings*, Fifth Ann. Conv., Underwater Soc. of Am., Mexico City, June (1964); "Magnetic Search For Bermuda Wrecks," *Explorers Journal* (1968); with John Ellis, "Bermuda's History under the Sea," *Oceans* (1969); "Treasure Hunting–Fact and Fancy," *Undercurrents* (1969); "Early Trade in America," *Oceans* (1969).

RODRIS ROTH, Associate Curator, Division of Costume and Furnishings. 1952: B.A., Minnesota; 1956: M.A., Winterthur Museum, Delaware. Specialty: 18th–and 19th–century domestic furnishings and interiors; current research on American furniture shown at the 1876 centenial exposition. Articles: "Tea Drinking in 18th–Century America. . .," *Cont. from the Mus. of Hist. and Tech.* (1961); "The Colonial Revival and 'Centennial Furniture,' " *Art Quarterly* (1964); "Floor Coverings in 18th–Century America," *Cont. from the Mus. of Hist. and Tech.* (1967). Sabbatical 1970–1971.

CARL H. SCHEELE, Associate Curator–in–Charge, Division of Postal History. 1952: graduate, Cleveland Institute of Art; 1953: B.F.A., Illinois; 1957: M.A., Western Reserve. Specialty: U.S. philately and postal history; current research on U.S. pneumatic tube postal service, 19th–century letter carrier service, 19th–century revenue stamp plate proofs, general survey of foreign, colonial, and U.S. postal history. Book: *Owney, Mascot of the Railway Mail Service* (1967). Articles: "A New Home for the Smithsonian's Philatelic and Postal History Collections," *The* [Am. Philatelic] *Cong. Book* (1964); "A Philatelic New Look at the Smithsonian," *Soc. of Philatelic Am. Journ.* (1964); "The Mitsui Donations to the Smithsonian Institution," *Japanese Philately* (1964); "Philately and Postal History at the Smithsonian Institution," *Scand. Scribe* (1965); "The Pneumatic Tube Mail Service in the United States," *Soc. of Philatelic Am. Journ.* (1966); with Victor H. Weill, "Postal Issues of France and Colonies at the Smithsonian . . . ,"*France and Colonies Philatelist* (1966); "The National Postage Stamp Collection: Smithsonian Institution," *Minkus Stamp Journ.* (1967); " 'Zoned' Addresses–The Early Experiments," *Soc. of Philatelic Am. Journ.* (1967); "On the 'Wilderness' of Philatelic Scholarship," *The* [Am. Philatelic] *Cong. Book* (1967).

C. MALCOLM WATKINS, Acting Chairman, and Curator–in–Charge, Division of Cultural History. 1934: B.S., Harvard; 1936–1942: Curator, Wells Historical Museum, Southbridge, Mass.; 1946–1948: Curator, Old Sturbridge Village, Mass. Specialty: U.S. material culture and its history, especially ceramics; current research on ceramics imported into America in the early colonial period, and the transfer and establishment of a ceramic folk industry in colonial America and its development and decline. Fieldwork: Great Britain, Virginia, California. Book: *The Cultural History of Marlborough, Virginia* (1968). Articles: "North Devon Pottery and Its Export to America in the 17th Century," *Cont. from the Mus. of Hist. and Tech.* (1961); "The Poor Potter of Yorktown," *Cont. from the Mus. of Hist. and Tech.* (1967).

JAMES M. WEAVER, Concert Director, Division of Musical Instruments. 1961: B. Mus., Illinois; 1963: M. Mus., Illinois; 1957–1959: Amsterdamsche Conservatorium; 1959: Haarlem Zomer Orgel Akademie; 1964–1966: Boston University, also Director of Music, Maple Street Church, Danvers, Mass. Specialty: use of early instruments and reproductions in present-day performance. Fieldwork: instrument collections in England, Western Europe, United States; contemporary makers in New England.

NATIONAL PORTRAIT GALLERY

MARVIN S. SADIK, *Director*

Objectives

The National Portrait Gallery was established by the Congress in 1962 to "function as a free public museum for the exhibition and study of portraiture and statuary depicting men and women who have made significant contributions to the history, development, and culture of the people of the United States and the artists who created such portraits and statuary."

The objective of the National Portrait Gallery's acquisition policy is to assure

1. That likenesses acquired are of persons who have contributed significantly to the culture of the country.
2. That appropriate recognition is given to various professions and occupations.
3. That equitable representation is achieved across the years from earliest colonial times to the present.

Facilities

The Gallery has moved to the Old Patent Office Building located at 8th and F Streets N.W. Recently remodeled for the purposes of NPG, it was formally opened to the public in the fall of 1968. The building, which dates from 1836, is well suited to gallery purposes and makes a distinguished addition to the Smithsonian museum complex.

Program

Not just an art museum, the National Portrait Gallery is a study center for those seeking information on distinguished Americans and the artists who portrayed them. The Gallery contemplates a program including extensive biographical, archival, and iconographical materials, a skilled and ample staff of librarians and scholars who will engage in their own research as well as assist professional visitors, and publication, the means by which the influence of the Gallery will be most widely felt. It will maintain a biographical and iconographical archive related not only to those persons represented in the exhibition collections but to many more of whom the Gallery is not fortunate enough to possess likenesses. This archive is expected to become a first-rate resource for scholars in American history and biography.

Research Staff

MARVIN S. SADIK, Director. 1954: A. B., Harvard; 1960: A. M., Harvard; 1955-1957: Curatorial Assistant, Worcester Art Museum; 1961-1964: Curator, Bowdoin College Museum of Art, Brunswick, Maine; 1964-1967: Director, Bowdoin College Museum of Art, Brunswick, Maine; 1967-1969: Director, Museum of Art, University of Connecticut; Specialty: American painting; Dutch 17th-century painting; Book: *Colonial and Federal Portraits at Bowdoin College* (1964); Article: "The Portrayal of the Negro in American Art," *Art in America* (1964).

MISS DOROTHY Z. BREWER, Historian. 1957: B.A., George Washington; 1959: M.A., George Washington; 1955–1957: Editorial Assistant, Public Affairs Press; 1965: Research Assistant for *The Smithsonian (American Heritage).* Specialty: American social history and biography. Speaks Spanish.

MONA L. DEARBORN, Research Assistant, Catalogue of American Portraits. 1948: B.A., Syracuse; 1949–1950: University of Colorado; 1948–1949: Registrar, Syracuse Museum of Fine Arts, Specialty: American painting and portraiture; portraiture in upstate New York and western Connecticut; graphics; contemporary ceramics. Reads French.

MONROE H. FABIAN, Assistant Curator. 1961: B.F.A., Pennsylvania; 1963–1966: Art Editor, *New Catholic Encyclopedia.* Specialties: American portraiture and folk art (especially Pennsylvania German); currently working on NPG collection. Article: "Some Moravian Paintings in London," *Pennsylvania Folklife* (1968).

ALEITA A. HOGENSON, Reference Librarian, NCFA and NPG Library. 1920–1924: library training course, Widener Memorial Library, Harvard; 1938: B.A., Bradley: 1946–1947: Assistant and Acting Librarian, Republican National Committee Library; 1947–1953: Librarian, Webber College Library; 1954–1967: Assistant Librarian, Freer Gallery of Art Library. Specialties: Oriental art bibliography, modern languages; currently working on fine arts bibliography. Speaks French, modern Greek.

CHARLES H. OLIN, Conservator, NPG/NCFA Conservation Laboratory. 1956: B.S., Dickinson; 1960–1961: Fine Arts Graduate School, Cornell; 1960–1964: Conservation Center, Institute of Fine Arts, New York University; 1965–1966: graduate physics, Georgetown; 1961: Assistant to the Director, Adirondack Museum; 1963–1966: Conservator-in-Charge, Conservation Analytical Laboratory, U.S. National Museum. Specialty: conservation of paintings, paper, and sculpture; current research on materials of 19th-century American artists, and new methods and materials for conserving oil paintings. Articles: "Conservation at the National Collection of Fine Arts," *Arts Mag.* (1968)). "Is Conservation Serving History?" (in press).

ROBERT G. STEWART, Curator, 1954: B.F.A., Pennsylvania; 1958–1961: Planning Consultant, St. Louis County Park Department; 1961–1964: Director, Department of Properties, National Trust for Historic Preservation; 1967–1968: Visiting Lecturer in Art, (Museology) George Washington University. Specialty: Anglo-American portraiture and iconography; currently supervising conservation and working on authentication of sitters and artists of portraits in the NPG collection or to be added to it. Books: *Nucleus for a National Collection* (1966); *Recent Acquisitions* (1966); *A Nineteenth Century Gallery of Distinguished Americans* (1969). Article: "Portrait of John Bartram Identified," *Garden Journ.* (1967); "Noah Webster by James Herring," *Smithsonian Journal of History* (1967).

ADDITIONAL SMITHSONIAN STAFF WITH INTERESTS RELATED TO AMERICAN STUDIES

RITA J. ADROSKO, Associate Curator, Division of Textiles. Specialties: pattern weaves in Europe and America in the 17th, 18th, and 19th centuries, and the use of natural dyes in America. Full listing under "Program in History of Science and Technology."

ALICE BALDWIN BEER, Special Consultant, Cooper-Hewitt Museum of Design. Specialties: medieval woven textiles; English and French printed cottons; lace and embroidery. Full listing under "Program in Cultural Studies."

PHILIP W. BISHOP, Chairman, Department of Arts and Manufactures. Specialties: Alexander Lyman Holley's contributions to American steel factory planning; history of metal fabrication in America and Great Britain; Andrew Ure's influence on the communication of technological information (1800-1850). Full listing under "Program in History of Science and Technology."

ADELYN DOHME BREESKIN, Curator of Contemporary Art, National Collection of Fine Arts. Specialty: art of Mary Cassatt. Full listing under "Program in Cultural Studies."

ROBERT M. CALLAND, Project Director, *Tecumseh* Project, National Armed Forces Museum Advisory Board. Specialty: preservation of heavy military and naval equipment. Full listing under "Program in History of Science and Technology."

HOWARD I. CHAPELLE, Senior Historian, Department of Science and Technology. Specialties: histories of American naval architecture and shipbuilding. Full listing under "Program in History of Science and Technology."

ELAINE ANNE EVANS DEE, Curator of Drawings and Prints, Cooper-Hewitt Museum of Design. Specialty: old master drawings (particularly French) and prints. Full listing under "Program in Cultural Studies."

JOHN M. ELLIOTT, Museum Specialist, National Armed Forces Museum Advisory Board. Specialty: U.S. naval and Marine Corps history and aeronautics. Full listing under "Program in Museum Studies."

JOHN C. EWERS, Senior Ethnologist, Department of Anthropology and Member, Center for the Study of Man. Specialty: ethnology of the American Indians. Full listing under "Program in Anthropology."

BERNARD S. FINN, Curator of Electricity, Department of Science and Technology. Specialties: 19th century physical sciences, and electricity. Full listing under "Program in History of Science and Technology."

DAVID E. HABERSTICH, Museum Specialist, Division of Graphic Arts and Photography. Specialties: history of photography and cinema; contemporary photographic art. Full listing under "Program in Museum Studies."

SHIRLEY S. HARREN, Technical Information Specialist, National Collection of Fine Arts and National Portrait Gallery Library. Specialty: sources of contemporary art, and art and archival computer applications. Full listing under "Program in Museum Studies."

JOHN N. HOFFMAN, Associate Curator, Division of Agriculture and Mining (Section of Mining). Specialties: mechanization of the U.S. coal industry; canal and railroad transportation of anthracite in the 19th century. Full listing under "Program in History of Science and Technology."

JAMES S. HUTCHINS, Assistant Director, National Armed Forces Museum Advisory Board. Specialty: American military history. Full listing under "Program in History of Science and Technology."

M.H. JACKSON, Curator, Division of Transportation (Curator of Marine Transportation). Specialties: history of privateering; the Caribbean; cartography and navigation; early voyages of discovery; the sailing ship; the Industrial Revolution. Full listing under "Program in History of Science and Technology."

JOHN H. MAGRUDER III, Director, National Armed Forces Museum Advisory Board. Specialty: military and naval history; military illustrator. Full listing under "Program in History of Science and Technology."

CHRISTIAN ROHLFING, Administrator, Cooper-Hewitt Museum of Design. Specialties: European decorative arts of the 20th century; color. Full listing under "Program in Cultural Studies."

MILTON FRANKLIN SONDAY, JR., Assistant Curator of Textiles, Cooper-Hewitt Museum of Design. Specialties: European and Near Eastern woven textiles; textile conservation; graphics. Full listing under "Program in Cultural Studies."

GENEVIEVE A. STEPHENSON, Museum Specialist, National Portrait Gallery. Full listing under "Program in Museum Studies."

JAMES J. STOKESBERRY, History, National Armed Forces Museum Advisory Board. Specialty: history of American science and technology; American military and naval history. Full listing under "Program in History of Science and Technology."

W.H. TRUETTNER, Curator of Painting and Sculpture, National Collection of Fine Arts. Specialty: 18th and 19th century English and American painting. Full listing under "Program in Cultural Studies."

ROBERT M. VOGEL, Curator, Division of Mechanical and Civil Engineering (Curator of Heavy Machinery and Civil Engineering). Specialties: history of civil engineering and mechanical engineering, particularly power machinery; industrial archeology in the United States. Full listing under "Program in History of Science and Technology."

PETER C. WELSH, Assistant to the Director of the U.S. National Museum. Specialty: economic and industrial history, specifically history of flour-milling and tanning industries in the United States. Full listing under "Program in Museum Studies."

JOHN HOXLAND WHITE, JR., Curator, Division of Transportation (Curator of Land Transportation). Specialties: 19th century railroad equipment design; locomotives, cars, rails, and the builders thereof. Full listing under "Program in History of Science and Technology."

CULTURAL STUDIES

INTRODUCTION

Cultural Studies at the Smithsonian are conducted in areas reflecting a wide range of human expression as represented by various esthetic traditions and manifestations of culture – past and present. The study and preservation of folk culture, the historical significance of portraiture and the symbolic characterization of society in the form of ancient and contemporary art all contribute to a comprehensive analysis of man's cultural imprint. The facilities of the several art museums along with a developing program in researching the performing arts and ethnic expression provide ample opportunity for the support of dissertation research and student participation at all levels. The third annual Festival of American Folklife has recently provided opportunities for a substantial number of undergraduate student interns to learn about segments of rural society previously ignored or unrecognized by the academic community. This annual Festival, initiated in 1967, has served as a point of departure in the development of new research programs about numerous areas of this country and will continue to represent a focal point for cultural studies at the Institution. Additional impetus to education in the cultural domain is drawn from seminars and lectures on both a graduate and undergraduate level. The widely differing educational activities are designed and conducted to give meaning and substance to a multitude of academic and esthetic tastes and lines of inquiry as evidenced at the Institution by students, scholars, and the general public.

In the field of Cultural Studies it is expected that the Office of Academic Programs will be able to offer a total of 10 Visiting Research Appointments in its programs of higher education and research training of which full stipends may be awarded to two Visiting Postdoctoral Research Associates and two to Visiting Research Associates (Ph. D. candidates).

In addition to the research staff listed below, other staff members with related interests will be found at the end of this section on Cultural Studies.

NATIONAL COLLECTION OF FINE ARTS

Robert T. Davis, *Acting Director*

Objectives

By Congressional mandate the National Collection of Fine Arts (NCFA) is instructed "to encourage the development of contemporary art and to effect the widest distribution and cultivation in matters of such art." In addition, ". . . it will consider its obligations to be the encouragement of a high standard of quality among artists in the fields of both the fine and practical arts . . . ." It was made clear that what was intended was an American equivalent of the Luxembourg Gallery in France and the Tate Gallery in England.

In the practical application of the mandate, the interpretation of its functions are the following:

1. Providing a repository for government art, with concern for conservation of art belonging to the government, e.g., Works Progress Administration (WPA) paintings.
2. Lending to government agencies, e.g., the White House, Art-in-the-Embassies, etc.
3. Encouraging the development of our native art wherever possible on a national scale.
4. Promoting the appreciation of art on a national scale; sponsoring traveling exhibits, within the United States and internationally.
5. Sponsoring the study of art; planning for the creation of a national study and archival center.
6. Supplying information on art; answering questions from this country and abroad.
7. Representing the government in art; serving as U.S. host to foreign embassies sponsoring exhibitions.
8. Encouraging crafts: carrying out the art mandate which in its widest sense includes the encouragement of and display of crafts.

Facilities

The move to its greatly enlarged new quarters in the handsome 19th-century classical-revival Old Patent Office Building, more recently the headquarters of the U.S. Civil Service Commission, took place in 1967. The formal opening of the galleries to the public occurred in the spring of 1968. The building stands in the square formed by 7th, 9th, F, and G Streets N.W., in the City of Washington. The National Collection of Fine Arts and the National Portrait Gallery share the services of a library, conservation department, and photographic laboratory.

The National Collection is concentrating on developing a continuing survey of American art, which comprises the main body of its exhibitions and reserve collections. These collections are already particulary strong in late 19th- and early 20th-century periods. The holdings in contemporary paintings have been substantially strengthened by the addition of the Irene and Herbert F. Johnson collection of the art of the early 1960s. Its total range extends to European and Oriental painting, sculpture, and the decorative arts as a result of several large private gifts.

The NCFA inaugurated a series of major shows of American art with the opening of the Stuart Davis Memorial Exhibition in May 1965 in a newly renovated gallery in its temporary home in the Museum of Natural History. The exhibit program, temporarily discontinued during the opening of the building, was reinstated in the new quarters in July 1968. These changing exhibitions may be said to reflect the high standards of presentation and scholarship of the NCFA and also the determination of the National Collection to present to the nation and the world unique opportunities to study the great achievements of American art. The publication of illustrated catalogs in conjunction with exhibitions is adding to the store of research material available to the public.

Through its reserve collection of original works of art, comprising nearly five thousand paintings, drawings, prints, and works in sculpture, housed in ample quarters, the NCFA is able to offer an unparalleled study facility in American art. This facility is further enhanced by the photographic collection, clipping file, and original documents which number upwards of one million items.

Possibilities for Research

Research and education programs of great potential significance in promoting an understanding of American art are undergoing rapid development. The key to this development has been the growth of staff, facilities, and resources of the past three years. The move to the expanded quarters of the Old Patent Office Building provided the space necessary to assemble and study the art and archival materials, strengthen the library, and quadruple the professional staff.

Programs which are now well under way include: staff recruitment, professional publications, scholarly exhibitions, expansion and reclassification of the collections, library and archival development, including photographic archives, research contracts, and student internship training.

A variety of additional research and educational activities has begun: development of an office of art education, postdoctoral research, graduate-level museum internships, docent training, and the display of the permanent collections (with catalogs).

In the near future, the National Collection expects to strenghten its research and education activities by further efforts at all levels within its programs. There are plans to appoint a scholar-in-residence, to add to the senior research staff, and to provide facilities for more pre- and postdoctoral scholars. Other areas that will undergo great expansion include the library and archives, the office of art education (with a development of school-level education materials), the traveling educational art exhibits, and the museum training programs.

Research Staff

ROBERT TYLER DAVIS, Acting Director, National Collection of Fine Arts. 1926: B.A., Harvard; 1928: M.A., Harvard; 1928–1929: Acadėmie de la Grand Chaumiére and Sorbonne, Paris. 1933–1934: Museum training courses, Harvard. 1929–1933: Instructor, University of Rochester; 1934–1939: Director of Education, Albright Art Gallery, Buffalo, New York; 1939–1947: Director, Portland Art Museum, Portland, Oregon; 1947–1952: Director, Montreal Museum of Fine Arts, Professor and Head of Art Department, McGill University; 1953–1957; Director, Vizcaya Dade County Art Museum, Miami, Florida; 1955–1956: Interim Director, Joe and Emily Lowe Gallery, University of Miami; 1956–1959: Coordinator of Humanities and Professor of Art, University of Miami; 1959–1968: Museum Consultant, French and Company, Inc., New York; 1968–1969; Assistant Director, National Collection of Fine Arts. Specialties: painting, sculpture, and the decorative arts, especially tapestry. Book: *Native Arts of the Pacific Northwest* (1947). Catalogs: *Exhibition of Chinese Sculpture* (1940); *Masterpieces of French Painting* (1941); *Paintings from the Bequest of C. F. Adams* (1944); *The Eighteenth Century Art of France and England/L'Art en France et en Angleterre du Dix-huitieme Siecle* (bilingual, 1950); *Six Siecles de Paysage/Six Centuries of Landscape* (bilingual, 1952) Article: "Views of Museum Directors," *Museum* (1951). Speaks French.

LOIS BINGHAM, Chief, International Art Program. 1936: B.A., Oberlin; 1942: M.A., Oberlin; 1939: Institut d'Art et d'Archėologie, University of Paris; 1948–1954: Associate Curator of Education, National Gallery of Art; 1954–1965: Fine Arts Specialist, U.S. Information Agency. Specialty: American art; currently preparing and circulating exhibitions of fine and applied arts of the U.S. throughout the world in conjunction with the cultural program of the U.S. Information Service, American embassies, and museums and universities abroad. Speaks French.

ADELYN DOHME BREESKIN, Curator of Contemporary Art. 1915–1918: Radcliffe; 1914–1918: School of Fine Arts, Crafts, and Decorative Design, Boston; 1953: D. Letters (hon.), Goucher; 1961: D.F.A. (hon.), Washington College; 1962: D.F.A. (hon.), Wheaton; 1966: D.F.A. (hon.) Hood; 1966: D.F.A. (hon.), Morgan; 1930–1962: Curator of Prints, Baltimore Museum of Art; 1942–1947: Acting Director, Baltimore Museum of Art; 1947–1962: Director, Baltimore Museum of Art; 1962–1964: Director and organizer, Washington Gallery of Modern Art. Specialty: art of Mary Cassatt; currently doing catalogue raisonnė of paintings, pastels, watercolors, and drawings by Mary Cassatt, and revising 1948 catalog of Cassatt prints. Books: *The Graphic Work of Mary Cassatt, (1948); Milton Avery, (1960). Articles: "Early Picasso Drawings in the Cone Collection," Mag. of Art* (1952); "Mary Cassatt, graveur," *L'Oeil* (1959); "A Tour of Washington's Art Museums," *Span,* USIA (1965); "Matisse in America," *Harp. Baz.* (1966): *Milton Avery* (exhibition catalogue) (1969); "Mary Cassatt Among the Impressionists," (introduction to catalogue) Joslyn Art Museum (1969). Speaks German, French.

MARGARET COGSWELL, Deputy Chief, International Art Program. 1947: B.A., Wellesley; studied also at Pratt Institute and School of the Art Institute of Chicago; 1958–1966: Head, Department of Publications, American Federation of Arts. Specialty: lithography and design; currently preparing and circulating exhibitions of fine arts of the U.S. throughout the world. Book: ed., *The American Poster* (1967). Speaks French.

ROBERT HUNTER, Museum Curator. 1962: B.A., University of Virginia; 1964; M.A., Princeton; 1965: Museum Training Program, Yale. Specialties: 18th-, 19th-, and 20th-century European and American painting; currently researching Thomas Cole, José de Rivera, and Thomas W. Dewing.

JACOB KAINEN, Special Consultant. 1930: graduate, Pratt Institute; 1936–1938: New York University; 1944–1946: George Washington. Specialities: chiaroscuro woodcuts, history of color printing, 16th- and 17th-century Dutch engraving, American printmaking, history of the printing press and of photomechanical printing; current research on Hendrick Goltzius (1558–1617), Dutch engraver. Books: *George Clymer and the Columbian Press* (1950); *The Development of the Halftone Screen* (1952); *John Baptist Jackson: 18th-Century Master of the Woodcut* (1962); *The Etchings of Canaletto* (1967). Articles: "Why Bewick Suceeded: A Note in the History of Wood Engraving," *Cont. from the Mus. of Hist. and Tech.* (1959); "Michael Ponce de Leon," Corcoran Gall. (1966); "Gene Davis and the Art of Color Interval," *Art Intl.* (1966). Speaks French, German.

HARRY LOWE, Curator of Exhibits. 1943: B.A., Auburn; 1949: M.A., Auburn: 1951–1953: Cranbrook Academy of Art, Bloomfield Hills, Michigan. 1949–1959: Professor of Art, Auburn University; 1959–1964: Director, Tennessee Fine Arts Center, Nashville; 1965, 1967–1969: Faculty member for Seminar for Historical Administrators, Williamsburg, Virginia. Specialities: Assembling, editing, constructing exhibitions (the *content* of and exhibition and its catalogue as well as its final design for presentation). Current research on destruction as an art movement in contemporary art, a syllabus for classes for beginning collectors of art, the art of Boris Anisfeldt. Article: "In Venice, Backstage at Biennale," *Museum News* (1966); Introduction to catalogue *Charles Sheeler, Smithsonian Institution Press* (1968).

DONALD R. McCLELLAND, JR., Associate Curator. 1954: B.A., Michigan; 1960: M.A., Michigan; graduate work, University of London, Mexico City College; 1959–1960: Museum Assistant, University of Michigan Museum of Art; 1960–1961: Research Assistant, Victoria and Albert Museum; 1962: lecturer and research associate, Corcoran Gallery of Art; 1969–1970, Chairman, Committee of Fine and Applied Arts, Graduate School, U.S. Department of Agriculture; lecturer, Adult Education, Catholic University. Specialty: 20th century American painting; current research on American 20th century painting, and American decorative arts and architecture, 1860–1880. Fieldwork: Michigan-Princeton expedition to the monastery of St. Catherine, Mt. Sinai, Egypt, to study Byzantine art and architecture. Articles: "Sudanese Perspective," *Mid-East* (1967) "Justin Pieris Daraniyagala," Government Printing Office (1969).

W. H. TRUETTNER, Associate Curator of Painting and Sculpture. 1957: B.A., Williams; 1959: M.A., Michigan; 1960: Princeton; 1962: Assistant Director, Arkansas Arts Center; 1962–1965: Staff Lecturer, National Gallery of Art. Specialty: 18th- and 19th-century English and American painting; currently researching late 19th- and early 20th-century collections; Emmanuel Leutze. Articles: "Portrait of America: 1865–1915," *IBM gall.* (1967); "The Genesis of Frederic Edwin Church's *Aurora Borealis*," *The Art Quarterly* (1968); "Portraits of Stephen Decatur by or after Gilbert Stuart," (in press). Speaks, French, German.

RICHARD P. WUNDER, Senior Research Fellow. 1949: B.A., Harvard; 1952: M.A., Harvard; 1953: Assistant to the Director, Fogg Art Museum, Harvard; 1955: Ph. D., Harvard; 1955–1964: Curator of Drawings and Prints, Cooper Union Museum; 1964–1968: Curator of Painting and Sculpture, National Collection of Fine Arts, Smithsonian; 1968–1969: Director, Cooper-Hewitt Museum of Design. Specialties: drawings of the old masters; 17th- and 18th-century Italian and French painting; decorative arts and design; 19th century American painting and sculpture. Currently studying monographs and catalogues raisonné on Frederic E. Church, Emmanuel Leutze, and Hiram Powers. Instrumentation and techniques: art museum administration and registration methods. Books: *Extravagant Drawings of the Eighteenth Century from the Collection of the Cooper Union Museum* (1962); *Architectural and Ornamental Drawings of the 16th to the Early 19th Centuries in the Collection of the University of Michigan Museum of Art* (1965); *Frederick Edwin Church* (1966); *17th and 18th Century European Drawings* (1966). Article: "The Architect's Eye," *Cooper Union Mus. Chron.* (1962). Speaks French.

COOPER-HEWITT MUSEUM OF DESIGN

Cooper Square at 7th Street, New York, New York 10003

MRS. LISA SUTER TAYLOR, *Director*

Formerly known as the Cooper Union Museum, the Cooper-Hewitt Museum of Design was founded in 1897 by the granddaughters of Peter Cooper, the Misses Sarah and Eleanor Hewitt. As one of the country's major assemblages of decorative-arts objects, representing world cultures spanning four thousand years, the Museum offers its services to designers and researchers in the history of the decorative arts.

Following the announcement in 1963 by the Trustees of the Cooper Union for the Advancement of Science and Art that the Museum was to be discontinued, a committee of public-spirited citizens was formed to attempt to save the Museum and keep its collections intact. Through the invited intervention of the American Association of Museums, a plan was formulated whereby the Smithsonian would agree to assume the responsibility of the Museum's continued operation in New York City through funds raised independent of federal support. This phase of its operation is now in effect.

Collections

The collections, which number close to a hundred thousand objects and a library of thirteen thousand volumes, provide a means of study in depth from a number of directions: industrial design, art history, cultural history, and techniques. The

Museum is particularly strong in textiles and lace, architectural and ornamental drawings and prints, wallpapers, metalwork, and ceramics and glass. A unique research facility supporting the collection of original objects is a cross-indexed card catalog by "design" or "motif" covering the Museum's entire holdings, and which is freely accessible to the general public.

Programs

The Cooper-Hewitt Museum's collections are interpreted by means of special display techniques and exhibitions, accompanied by illustrated catalogs and brochures. Color, enamel, textile printing, jewelry design, paper-folding, and the art of advertising have all been given special emphasis through didactic shows, and by such means it is the Museum's intent to emphasize the current need for improved design, thus leading to a better aesthetic control of our environment. In addition the Museum also sponsors an annual publication, the *Chronicle*, devoted to scholarly articles in the field of the decorative arts, laying particular emphasis on various segments of the collection. Comprehensive catalogs and checklists of the collections are also in process of publication.

Cooperation

In recognition of its responsibilities through the fostering of better design, implemented through its curatorial staff and the existing collections, it is anticipated that cooperation between the Cooper-Hewitt Museum and other bureaus of the Smithsonian, as well as with museums abroad, will lead to a closer cultural rapport between the decorative arts, thus defined, and other forms of man's humanistic expression.

Research Staff

ALICE BALDWIN BEER, Special Consultant. 1910: B.A., Vassar. Specialties: medieval woven textiles; English and French printed cottons; lace and embroidery. Fieldwork: France, Spain. Book: *The Greenleaf Collection* (1964). Article: "The Embroidery Collection of the Cooper Union Museum," *Embroidery* (1960). Speaks Spanish, French.

ELAINE ANNE EVANS DEE, Curator of Drawings and Prints. 1945: B.A., Oberlin; 1951: M.A., Radcliffe; 1956–1960: Curator of Drawings of Ancient Art and Coins, Newark Museum; 1961–1968: Assistant Curator of Drawings and Prints, Pierpont Morgan Library. Specialty: old master drawings (particularly French) and prints. Fieldwork: France, Belgium, Italy. Books: *Nineteenth and Twentieth Century European Drawings* (1965); contributor to A. Mongan, ed., *One Hundred Master Drawings* (1949). Speaks French, German, Italian.

MILTON FRANKLIN SONDAY, JR., Assistant Curator of Textiles. 1961: B.F.A., Carnegie Institute of Technology; 1966–1967: Assistant Curator, Textile Museum. Specialties:

European and Near Eastern woven textiles; textile conservation; graphics. Fieldwork: Canada. Has done illustrations and diagrams for various books and articles on textile techniques and conservation. Speaks German.

CHRISTIAN ROHLFING, Administrator. 1947: University of Chicago; 1947–1950: Assistant Director of Theater, University of Chicago; 1950–1954: Display Coordinator, Georg Jensen, Inc. Specialties: European decorative arts of the 20th century; color. Books: *Method and Style in Restoration* (1960); introduction to K. Kelly, ed., "A Universal Color Language," *Mus. News* (1965). Speaks German, French.

FREER GALLERY OF ART

JOHN A. POPE, *Director*

The objectives of the Freer Gallery of Art were clearly set forth by the founder in his will. He made only two provisions: The Gallery was to engage in (a) the study of civilizations of the Far East and (b) the promotion of the highest ideals of beauty. It is under the second provision that Oriental objects of the highest quality are purchased to augment the collections. As the number of Near Eastern objects has increased, the first provision has gradually broadened in recent years to include the study of Near Eastern civilizations as well.

Collections

The Freer gallery collections are highly specialized in the field of Oriental art: In round numbers they comprise some 4,000 Chinese objects, 2,000 Japanese, and 3,000 from the Near East and India. Other miscellaneous subheadings include the 1,500 works of American art collected by Mr. Freer during his lifetime.

Chinese bronzes, Chinese paintings, and Chinese ceramics form especially strong parts of the collections. In the Japanese field the Gallery is probably strongest in painting and has a good collection of ceramics. In the Near East its principal strength is in the field of Persian miniatures and early Persian metalwork.

Publications and Lectures

The principal series of publications are the *Freer Gallery of Art Oriental Studies,* in which the recent catalog of the Freer Chinese bronzes is No. 7, and the *Freer Gallery of Art Occasional Papers,* of which three volumes; nine numbers, have appeared. The Gallery has a regular annual series of six illustrated lectures on

Oriental art. The auditorium facilities are available to outside organizations and are in use frequently.

Facilities

To serve the research program in the civilizations of the Near and Far East, a specialized library keeps abreast of the most important books related to objects in the collections and to the civilizations that produced them. About half of the 30-odd thousand volumes are in Western languages, and the rest are in Chinese, Japanese, Arabic, Farsi, and other Oriental languages.

A technical laboratory carries on a program of research on the materials and methods of the ancient craftsmen of Asia with the twofold goal of broadening knowledge of the history of technology and of increasing the Gallery's ability to protect and preserve the objects in the collections.

Cooperation

The Gallery is recognized as an established research center in its field and is visited by scholars from all over the world who consult the staff, use the library facilities, and, most important of all, work with the objects in the collections. Members of the staff are always available to help museums which do not have Orientalists regularly employed.

Grants for Study

The Gallery maintains a close working relationship with the University of Michigan, to which Mr. Freer bequeathed a sum of money for that purpose. Properly qualified graduate students at the University may apply for Freer Scholarships to carry on their work in Ann Arbor; and at a more advanced level they may apply for Freer Fellowships, under which they may spend a year at the Gallery writing their doctoral dissertations. Information on these grants may be obtained from the Chairman, Department of the History of Art, University of Michigan, Ann Arbor, Michigan 48104.

Holders of the Louise Wallace Hackney Scholarship, administered by the American Oriental Society, may choose to use that stipend working at the Gallery. Further information on the Hackney Scholarship, for advanced students of Chinese painting, may be obtained from the Secretary, American Oriental Society, 329 Sterling Memorial Library, Yale University, New Haven, Connecticut 06520. All research work at the Freer Gallery requires a working knowledge of one or more of the following Oriental languages: Chinese, Japanese, Arabic, Farsi. For the Hackney Scholarship, Chinese is mandatory.

Research Staff

JOHN A. POPE, Director. 1930: B.A., Yale; 1940: M.A., Harvard; 1955: Ph.D., Harvard. Research Professor of Oriental Art, University of Michigan. Specialties: Chinese and Japanese art, especially ceramics, lacquer, and metalwork. Fieldwork: studies of museum and private collections in Europe and the Near and Far East, and visits to excavations in Borneo. Books: *Ming Porcelains in the Freer Gallery of Art* (1953); *Chinese Porcelains from the Ardebil Shrine* (1956); with Aschwin Lippe and James F. Cahill, *Chinese Art Treasures, Exhibited in the United States by the Government of the Republic of China* (1961); co-author, *The Freer Chinese Bronzes,* vol. 1 (1967). Article: "Fourteenth Century Blue-and-White, a Group of Chinese Porcelains in the Topkapu Sarayi Muzesi, Istanbul," *Freer Gall. of Art Occasional Papers* (1952). Speaks French, German, Chinese, Japanese.

W. T. CHASE, III, Head Conservator, Freer Gallery Laboratory. 1962: A.B., Oberlin; 1967: M.A., New York. Specialty: technical studies on Near and Far Eastern art, especially pigments, metals, metal corrosion products, and minerals in art. Fieldwork: archeological studies in Turkey. Speaks German.

RUTHERFORD J. GETTENS, Consultant, Freer Gallery Laboratory; Member, Board of Consulting Fellows for the Conservation Center, Institute of Fine Arts, New York University. 1923: B.S., Middlebury; 1929: M.A., Harvard. Specialty: technical studies on Near and Far Eastern art, especially pigments, metals, metal corrosion products and metals in art. Book: with G. L. Stout, *Painting Materials: A Short Encyclopedia* (1942, 1966). Articles: "Maya Blue: An Unsolved Problem in Ancient Pigments," *Am. Antiquity* (1962); "Minerals in Art and Archaeology," *Ann. Rpt. of the Sm. Inst. 1961* (1962); "The Corrosion Products of Metal Antiquities," *Ann. Rpt. of the Sm. Inst. 1963* (1964).

THOMAS LAWTON, Assistant Curator, Chinese Art. 1953: B.S., Durfee Technical Institute; 1959: M.F.A., Iowa; 1965–1967: Advisor to the National Palace Museum, Taiwan. Specialty: Chinese art, especially painting. Articles: "Two Han Funerary Reliefs," *Oriental Art* (1960); "Scholar and Servants," *Natl. Pal. Mus. Bul.* (1966). Speaks Chinese, Japanese, French, German.

HAROLD P. STERN, Assistant Director. 1943: B.A., Michigan; 1948: M.A., Michigan; 1959: Ph.D., Michigan. Honorary Lecturer in Japanese Art, University of Michigan. Specialties: Japanese and Chinese Art, especially Japanese painting (Ukiyoe, Yamatoe, screens) and Japanese ceramics and decorative arts. Books: *Masterpieces of Korean Art* (1957); *Hokusai: Paintings and Drawings in the Freer Gallery of Art* (1960); introduction to "Japanese Drawings" in *Great Drawings of All Time* (1965). *Master Prints of Japan,* Ukiyo-e Hanga (1969). Languages: Japanese and German. Reads Chinese.

JOSEPH H. HIRSHHORN MUSEUM AND SCULPTURE GARDEN

ABRAM LERNER, *Director*

Upon the formal opening of the Hirshhorn Museum and Sculpture Garden in 1970–1971, the Joseph H. Hirshhorn Collection will be available in its entirety to the public and scholars. Research and educational facilities are planned for this new museum on the Mall in Washington, designed by Gordon Bunshaft, to complement its spacious galleries for rotating exhibitions and for display of the permanent collection.

Born of one man's unique passion for art, the Hirshhorn Collection is deeply concerned with major developments in the fields of contemporary painting and sculpture. The scope of the sculpture section is international, ranging from Antiquity to the sixteenth-to-nineteenth-century Benin bronzes of Nigeria to the work of today's young creators. Its outstanding monumental sculptures, European and American, from the nineteenth and twentieth centuries form a focal point of the Collection. In the painting section, while many contemporary Europeans are represented, the focus is on America. Beginning with such precursors as Homer and Eakins, the Collection surveys the course of twentieth-century American painting. Among the many major artists represented in depth are Hartley, Chase, Eilshemius, Walkowitz, Stella, Rivers, Gorky, and de Kooning. Since it was given to the United States in 1966, the Collection has acquired many significant paintings and sculptures.

Although the Hirshhorn Collection has always maintained an active loan program and has cooperated extensively with art historians and writers, at present its physical facilities for research are limited. Thus the staff looks forward to welcoming in the near future both graduate research fellows and visiting scholars to the new Hirshhorn Museum.

Research Staff

ABRAM LERNER, Director. 1935: B. A. New York; 1930–1935: trained in painting and drawing at various art schools; 1955–1956: study trip to Italy, the Netherlands, England, Belgium, France; Artist, Federal Art Project; 1934–1945: Artist-Illustrator, Army Quartermaster Corps; 1944–1954: Assistant Director, American Contemporary Art Gallery and Artists Gallery, New York; 1958: one-man exhibition, Davis Gallery, New York, and numerous national and group exhibitions; 1956–1967: Curator, Joseph H. Hirshhorn Collection. Specialty: contemporary painting and sculpture. Articles: "The Hirshhorn Collection" *The Museum World, Arts Yearbook 9* (1967); essays on Thomas Eakins and Edward Hopper in *From El Greco to Pollock*, Baltimore Museum Art (1968). Speaks German, Italian.

CYNTHIA J. JAFFEE, Assistant Curator. 1963: B. A. Cornell; 1967: M. A. Columbia. 1966: *Nakian* Exhibition, Museum of Modern Art; 1966–1967: *The Lower East Side: Portal to American Life* Exhibition, Jewish Museum; 1966–1968: Collection of Mr. and Mrs. David Lloyd Kreeger; 1967–1969: Council on the Arts. Specialty: 20th century American sculpture, painting, and architecture; current research on Nakian catalogue raisonné, and on Arnold Friedman and the 1908 Independent Exhibition. Articles: "Reuben Nakian: Biographical Notes and Bibliography," *Venice 34, The Figurative Tradition in Recent American Art.* Smithsonian Institution Press (1968). Speaks French.

FRANCES R. SHAPIRO, Historian 1965: B. A. University of Pennsylvania; 1968: M. A. Columbia 1967: student at the Sorbonne and L'Ecole du Louvre. Specialty: 19th century French painting, modern architecture. Speaks French.

ADDITIONAL SMITHSONIAN STAFF WITH INTERESTS RELATED TO CULTURAL STUDIES

JOHN T. FESPERMAN, Associate Curator-in-Charge, Division of Musical Instruments. 1948: B.S., Davidson; 1951: B.Mus., Yale; 1956: Amsterdamsche Conservatorium; 1960: M.Mus., New England Conservatory; 1959–1965: Faculty Member, New England Conservatory; 1960–1965: Director of Music, Old North Church. Specialty: 17th- and 18th-century keyboard music and keyboard instruments, especially organs. Fieldwork: early 18th-century organs in northern Europe. Books: *The Organ as a Musical Medium* (1960); *Checklist of keyboard Instruments at the Smithsonian* (1967). Articles: "Rhythmic Alerations in 18th- Century French Keyboard Music," *Organ Inst. Quarterly* (1966); "Music and Organs at the Old North." *Organ Inst. Quarterly* (1966); "Music for Small Organ," *Journ. of Church Music* (1966); "Report from Washington," *Current Musicology* (1968). Speaks Dutch.

MRS. CYNTHIA A. HOOVER, Associate Curator, Division of Musical Instruments. 1957: B.A., Wellesley; 1958: M.A.T., Radcliffe; 1961: M.F.A., Brandeis; 1958–1960: Teaching Assistant, Wellesley College. Specialty: musical instruments made and used in America; current research on musical instruments in 18th- and 19th-century America. Article: "The Slide Trumpet in the Nineteenth Century" (1963), "A Trumpet Battle at Niblo's Pleasure Garden," *Musical Quarterly* (1969).

JOHN C. EWERS, Senior Ethnologist, Department of Anthropology, and Member, Center for the Study of Man. Specialty: ethnology of the American Indians. Full listing under "Program in Anthropology."

DAVID E. HABERSTICH, Museum Specialist, Division of Graphic Arts and Photography. Specialties: history of photography and cinema; contemporary photographic art. Full listing under "Program in Museum Studies."

J. JEFFERSON MILLER II, Associate Curator, Division of Ceramics and Glass. Specialties: 18th- and 19th-century English transfer-printed earthenware made for the American market; 18th-century European porcelain; classification of ceramics from archeological excavations at American historical sites. Full listing under "Program in History of Science and Technology."

J. SCOTT ODELL, Museum Specialist, Division of Musical Instruments. Specialties: musical instrument conservation; American folk musical instrument history. Full listing under "Program in Museum Studies."

JACQUELINE S. OLIN, Research Chemist, Conservation-Analytical Laboratory; Research Collaborator, Brookhaven National Laboratory. Specialty: technical studies on materials of art and archeology, especially the application of analytical chemistry. Full listing under "Program in Museum Studies."

EUGENE OSTROFF, Supervisor, Division of Graphic Arts, and Curator of Photography. Specialties: preservation and restoration of photographs; history of photography. Full listing under "Program in History of Science and Technology."

WILLIAM C. STURTEVANT, Curator, Division of North American Anthropology, and Member, Center for the Study of Man. Specialties: ethnology, with area emphasis on eastern North America, Burma, and 16th-century West Indies, and topical emphasis on ethnohistory, ethnoscience, linguistics, ethnobotany and material culture. Full listing under "Program in Anthropology."

C. MALCOLM WATKINS, Curator-in-Charge, Division of Cultural History. Specialty: U.S. material culture and its history, especially ceramics. Full listing under "Program in American Studies."

JAMES M. WEAVER, Concert Director, Division of Musical Instruments. Specialty: use of early instruments and reproductions in present-day performance. Full listing under "Program in American Studies."

PETER C. WELSH, Assistant to the Director of the U.S. National Museum. Specialty: economic and industrial history, specifically history of flour-milling and tanning industries in the U.S.. Full listing under "Program in Museum Studies."

MUSEUM STUDIES

INTRODUCTION

The Smithsonian Institution, with its complex of museums, is one of the richest centers in the world for research in primary museum functions. Conservation laboratories, exhibits facilities, curatorial functions, photographic and media laboratories, as well as supporting administrative offices, all represent research and the developing associated activities of the modern museum. The special equipment used in the conservation of museum collections include instrumentation for X-ray spectography and X-ray diffraction, optical emission spectography and other resources for metallography as well as microscopic examination of non-metals. Studies of reference systems comprise the organization of collections as data banks and their integration with scientific and scholarly literature. Research and experimentation in the effectiveness of exhibits and the reaction of viewers is a fundamental research activity and objective in a continuing effort of meaningful exhibit presentation. The analysis of museum display techniques offers numerous possibilities for experimentation. A start in this direction is currently under way in the form of a special summer institute consisting of both graduate and undergraduate students who, under the direction and supervision of members of the Smithsonian staff, are pursuing inquiries and formulating impressions on the relevance of exhibits and the interaction between displays and the visitor. The field of museum studies as a recognized academic discipline has been long neglected. But the Smithsonian Institution is committed to fostering training and experiment in this area of study so fundamental to national needs for strengthened museum performance.

In the field of Museum Studies it is expected that the Office of Academic Programs will be able to offer a total of 8 Visiting Research Appointments in its programs of higher education and research training of which full stipends may be awarded to two Visiting Postdoctoral Research Associates and two Visiting Research Associates (Ph.D. candidates).

Museum Research and Technical Staff

ROBERT G. STEWART, Museum Research and Technical Staff Curator, National Portrait Gallery. 1954: B.F.A., Pennsylvania; 1958-1961: Planning Consultant, St. Louis County Park Department; 1961–1964: Director, Department of Properties, National Trust for Historic Preservations; 1967–1968: Visiting Lecturer in Art, (Museology) George Washington University. Specialty: Anglo-American portraiture and iconography; currently supervising conservation and working on authentication of sitters and artists of portraits in the NPG collection or to be added to it. Books: *Nucleus for a National Collection* (1966); *Recent Acquisitions* (1966); *A Nineteenth Century Gallery of Distinguised Americans* (1969). Article: "Portrait of John Bartram Identified," *Garden Journ.* (1967); "Noah Webster by James Herring," *Smithsonian Journal of History* (1967).

ALAN B. ALBRIGHT, Museum Specialist, Division of Military History. 1962: B.A., Oklahoma State. Specialties: wood preservation and Spanish colonial artifact identification; current research on shipwreck identification. Field work: Sackets Harbor, N. Y.; Bermuda; Port Royal, Jamaica; Lake Champlain, New York; U.S. Virgin Islands; British Virgin Islands. Article: "The Preservation of Small Waterlogged Wood Specimens with Polyethylene Glycol," Council of Underwater Arch. (1967).

DORIS M. BOWMAN, Museum Specialist, Division of Textiles. Studies at George Washington University. Specialty: hand- and machine-made laces and embroideries made or used in America; current research on early machine-made nets produced on the knitting machine.

JOHN M. ELLIOTT, Major, United States Marine Corps (Retired), Museum Specialist, National Armed Forces Museum Advisory Board. 1942–1965: United States Marine Corps. Specialty: United States Naval and Marine Corps history and aeronautics. Current research on painting and insignias of United States naval aircraft, 1912 to date. Articles: "Minigun's the Answer," *United States Marine Corps Gazette (1965); "The Marine* Corps's First Fighter Squadron," *Journal of the American Aviation Historical Society*, (1968).

DAVID E. HABERSTICH, Museum Specialist, Division of Graphic Arts and Photography. 1963: B.F.A., Rochester Institute of Technology; 1963–1964: Indiana; 1970: M.L.A. Candidate, John Hopkins. Specialties: history of photography and cinema, contemporary photographic art; current research on photography in surrealism and its affinities. Article: "Which History of Photography is Best?" *Popular Photography* (1966); "Gide and the Fantasts: The Nature of Reality and Freedom," *Criticism* (1969).

SHIRLEY S. HARREN, Technical Information Specialist, NCFA and NPG Library 1951: B.F.A., Denver University, 1951–1952: Library Assistant, Denver Art and Music Library; 1962–1964: Library Assistant, Smithsonian Institution Libraries. Specialty: sources of contemporary art; art and archival computer applications; currently doing fine arts bibliography. Speaks French, German.

DONALD E. KLOSTER, Museum Specialist (Uniforms), Division of Military History. 1961: B.A., Luther; 1966: M.A., George Washington; 1947–1950: Assistant to the Curator, Norwegian-American Historical Museum, Decorah, Iowa, Specialty: U.S. Regular Army uniforms; current research in period 1800–1855. Book: with Edgar M. Howell, *United*

States Army Headgear to 1854 (1969). Article: "Uniforms of the Army Prior and Subsequent to 1872." *The Mil. Collector and Historian (1962, 1963). Speaks Norwegian, Danish, Icelandic, German.*

J.SCOTT ODELL, Museum Specialist, Division of Musical Instruments. 1957: B.A., Middlebury; 1959–2963: associated with William Dowd, harpsichord maker, Cambridge, Mass. Specialties: musical instrument conservation, American folk musical instrument history; currently involved in musical instrument restoration. Fieldwork: tape recordings in southwestern Virginia, North Carolina, Tennessee. Articles: "18th Century French Harpsichord," *Smithsonian Journal of History* (1966); "The Appalachian Dulcimer," *1968 Festival of American Folklife* (1968).

CHARLES H. OLIN, Conservator, NPG/NCFA Conservation Laboratory. 1956: B.S., Dickinson; 1960–1961: Fine Arts Graduate School, Cornell; 1960–1964: Conservation Center, Institute of Fine Arts, New York University; 1965–1966: graduate physics, Georgetown; 1961: Assistant to the Director, Adirondack Museum; 1963 – 1966: Conservator-in-Charge, Conservation Analytical Laboratory, U.S. National Museum. Specialty: conservation of paintings, paper, and sculpture; current research on materials of 19th-century American artists, and new methods and materials for conserving oil paintings. Articles: "Conservation at the National Collection of Fine Arts," *Arts Mag.* (1968); "Is Conservation Serving History?" (in press).

GENEVIEVE A. STEPHENSON, Museum Specialist, National Portrait Gallery. 1940: B.A., Bennett; 1964: M.S.L.S., Catholic University; formerly Reference Librarian for prints and photographs relating to the history of medicine, National Library of Medicine. Currently cataloging and maintaining the NPG collection of photographs and print material. Reads French.

UNITED STATES NATIONAL MUSEUM

Frank A. Taylor
Director, U.S. National Museum

Cooperation with Other Museums

One of the missions of the Office of the Director of the U.S. National Museum is the advancement of museum arts and sciences, aided by the resources of all components of the Smithsonian Institution. It thus welcomes inquiries regarding projects that might be worked out cooperatively with other museums and their professional associations. The projects might involve museum administration, museum services, exhibits evaluation, and conservation of objects.

Conservation

To serve the various museums of the Smithsonian Institution the Conservation-Analytical Laboratory functions under the Office of the Director of the U.S. National Museum. Its speciality is the application of the exact sciences to the study and conservation of museum objects. This laboratory possesses a small specialized library and equipment for physical and chemical methods of analysis. Skills include neutro-activation analysis, X-ray spectrography and X-ray diffraction, optical-emission spectrography (U. V. and visible), infrared spectrophotometry, metallography and microscopic examination of non-metals, microchemical analysis, and experience in conservation procedures.

Actual treatment of objects in quantity is limited by lack of space but cooperation with other laboratories may permit experience to be gained in treatment of bronze, brass, iron, lead, tin, pewter, wood, leather and animal products, ceramics, and graphic art on paper. Theoretical background to practical work is available through lectures, seminars, and bibliographies.

Exhibits

The staff of the Office of Exhibits Programs, in consultation with museum scientists and historians, designs, prepares, and installs exhibits in Smithsonian museums. It occasionally prepares circulating exhibits for the Smithsonian Traveling Exhibition Service. The Office of Exhibits Programs continually experiments with new techniques and methods of presentation. The large numbers of exhibits of art, history, and science and the huge and varied audience visiting Smithsonian exhibits provide outstanding opportunities to experiment with and study the effectiveness of exhibits and the reactions of viewers to them. Experiments and plans are being made to investigate basic factors of the viewer's involvement with museum objects and his perception of exhibits.

Research and Exhibits Staff

FRANK A. TAYLOR, Director, U.S. National Museum. 1928: B.S., Massachusetts Institute of Technology; 1934: LL. B., Georgetown; 1928-1932: Assistant Curator, U.S. National Museum; 1931: Instructor in Mechanical Engineering, Catholic University of America; 1932–1948: Curator, Division of Engineering, U.S. National Museum; 1948–1955: Head Curator, Department of Engineering and Industries, U.S. National Museum; 1955–1958: Assistant Director, U.S. National Museum; 1958–1964: Director, Museum of History and Technology, U.S. National Museum. Specialty: museum administration, and consulting work in that field. Fieldwork: industrial museums in Europe. Articles: sections in *Dictionary of American Biography* (1928); "Catalog of the Mechanical Collections of the Division of Engineering," *USNM BUL. 173* (1939); also technical articles on history of technology, biography, museum planning.

CARL A. ALEXANDER, Exhibits Specialist and Acting Training Officer, Office of Exhibits Programs. 1957: B.A., Howard University; 1957–1959; graduate work in graphic arts, Howard University. 1959–1960: Exhibits Technician, Smithsonian Office of Exhibits. Specialty: exhibits production. Special techniques: silkscreen process and other phases of exhibits production.

JOHN E. ANGLIM, Chief, Office of Exhibits Programs. Schooling: Chicago Academy of Fine Arts; Chicago Art Institute. 1942–present; exhibits work at the Smithsonian Institution. Specialties: exhibit design, administration and planning.

EUGENE F. BEHLEN, Special Projects Supervisor, Office of Exhibits Programs. 1953: B.F.A., Wittenberg University, Ohio; 1955: M.A., Ohio State University; 1955–1957: U.S. Navy. 1958–1967: exhibits technician, coordinator, and team supervisor for production. Specialty: audiovisuals, lighting, training, and restoration. Special techniques: all phases of exhibits design and production.

BENJAMIN LAWLESS, Assistant Chief, Office of Exhibits Programs. 1952–1953: Assistant Director, Saginaw Museum, Saginaw, Michigan. 1953–present: exhibits work at the Smithsonian Institution. Specialties: exhibit design, painting and cinematography. Special techniques: exhibits design and concept.

JAMES A. MAHONEY, Chief of Design, and Chief, MNH Laboratory, Office of Exhibits Programs. 1958: B.F.A., Philadelphia College of Art; 1958–1963: Senior Designer, Museum of History and Technology; 1960–1963: Consultant, National Geographic Society; 1963–1966: Exhibit Consultant and Designer, National Air and Space Museum; 1966–1968: Assistant Director (Exhibits), National Air and Space Museum. Specialty: design. Special techniques: design and application of related arts to design.

JACQUELINE S. OLIN, Research Chemist, Conservation-Analytical Laboratory; Research collaborator, Brookhaven National Laboratory (Associated Universities, Inc.). 1954: B.S., Dickinson; 1955: M.A., Radcliffe; 1955–1956: Pennsylvania; 1962: New York University. Guest Worker, National Bureau of Standards. 1959–1960: Instructor in Chemistry, Dickinson College; 1960–61: Research Assistant, Department of Engineering Physics, Cornell University. Specialty: technical studies on materials of art and archeology, especially the application of analytical chemistry; current research on neutron activation analysis of ceramics and glass. Articles: "The Use of Infrared Spectrophotometry in the Examination of Paintings and Ancient Artifacts," *Instrument News* (1966); with E.V. Sayre, "The Analysis of English and American Pottery of the American Colonial Period," *Brookhaven National Laboratory* (1968); with E.V. Sayre, "Compositional Categories of some English and American Pottery of the American Colonial Period," *Brookhaven National Laboratory* (1968); with M.E. Salmon and C.H. Olin, "Investigations of Historical Objects Utilizing Spectroscopy and other Optical Methods," *Applied Optics* (1969).

ROBERT ORGAN, Chief, Conservation-Analytical Laboratory. 1950: A.G.T. (Birm.), University of Aston in Birmingham, England; 1960-1965: Chief Experimental Officer, Research Laboratory, British Museum; 1965–1967: Curator of Conservation, Royal Ontario Museum, Toronto. Specialty: general conservation, including investigations of materials and conservation methods; special interest in technology and conservation of ancient metals. Instrumentation and techniques: Conservation of Museum objects and related instrumentation. Book: *Design For Scientific Conservation Of Antiquities*, Smithsonian Institution Press (1969). Articles: with H.J. Plenderleith, "The Decay and Conservation of Museum Objects of Tin," Smithsonian Institution Press (1952); "Carbowax and Other Materials in the Treatment of Water-logged Paleolithic Wood," *Studies in Conservation IV* (1959); "Are Analyses of Uncorroded Ancient Alloys Representative?" *Studies in Conservation VII* (1962); "The Consolidation of Fragile Metallic Objects," IIG. *Recent Advances in Conservation* (1963); "Analysis and Microscopic Study of Metals" in E. Pyddoke, ed., *The Scientist and Archaeology* (1963); "Reclamation of the Wholly-Mineralized Silver in the Ur Lye," *Application of Science in Examination of Works of Art, Boston Museum of Fine Arts* (1965); "Humidification of Galleries For a Temporary Exhibition," *Museum Climatology* (1967).

PETER C. WELSH, Assistant to the Director of the U.S. National Museum. Editor, *Smithsonian Journal of History*. 1950: B.A., Mt. Union; 1951: University of Virginia; 1954–1956: Hagley Fellow; 1956: M.A., Delaware; 1956–1959: Fellowship Coordinator, Eleutherian Mills Hagley Foundation, Greenville, Del. Specialty: economic and industrial history, specifically history of flour-milling and tanning industries in the United States; current research on material aspects of American civilization. Books: *Tanning in the United States* (1964); *American Folk Art* (1966); *Track and Road: The American Trotting Horse, 1820–1900* (1967). Article: "Woodworking Tools 1600–1900," *Cont. from the Mus. of Hist. and Tech.* (1966).

SMITHSONIAN INSTITUTION LIBRARIES

RUSSELL SHANK, *Director*

The Smithsonian Institution Libraries are engaged in developing a research program in both library and information science aimed at increasing the theoretical knowledge on which modern library and information systems can be developed and in applied research and development on information systems for direct application in museum and similar research libraries. The program has as one of its major objectives the integration of information systems for controlling and utilizing knowledge that exists in both the national collections of objects and the Libraries' literature collections.

The Smithsonian Institution has a strong precedent of involvement in information service and library activities. Its first Assistant Secretary, C.C. Jewett, over a century ago formulated fundamental concepts for the creation of national cataloging and bibliographic enterprises, such as unit card production and distribution from a national center and cumulated printed catalogs. His survey of public libraries in the United States is a landmark document that set the pattern for similar inventories for more than a century. Although the initial Smithsonian Institution library collection was deposited in the Library of Congress in 1866, strong and carefully selected research collections were subsequently developed to support the work of curators and scientists in the Institution. These research collections now contain 700,000 volumes and documents.

In addition to the Libraries, the Smithsonian Institution administers several other information and publication distribution programs of concern to library and information system managers. Chief among these are the Smithsonian International Exchange Service and the Science Information Exchange. Together with the Libraries, these agencies form an environment for the study of various problems and patterns of the acquisition, publication, and dissemination of information. Although these agencies are administratively separate, they maintain close contacts through meetings of administrators of the agencies.

The Smithsonian Institution Libraries' collections are housed in a central library facility and in branches in the major museums and offices of the Smithsonian Institution. Among these branches are those in the Museum of History and Technology, the National Air and Space Museum, the National Collection of Fine Arts/National Portrait Gallery, the National Zoological Park, the Radiation Biology Laboratory, the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts, the Smithsonian Tropical Research Institute in Panama Canal Zone, and branches in the Museum of Natural History covering the topics of botany and entomology. A branch is also maintained to support the work of the Smithsonian Department of Anthropology. Many section libraries are housed in departmental offices throughout the museums.

The Smithsonian Institution Libraries have embarked on a program of modernization and development of information and publication retrieval programs and the creation of networks for the exchange of information with other museums and research libraries. The library system seeks to develop creative service programs to enhance the work of its users. Among the Libraries' fields of concern that are subject to research, therefore, are the theory and application of classification and file organization, particularly for computerization of information systems, the management of information and literature acquisition programs, concept identification and other elements of the human aspects of communication, the use of computers in the service of the humanities, network design and equipment configuration and network operations, scientific publishing, the economic, technical and social problems of the public communication of scientific information, and the history of library and information science. The Libraries are particularly interested in studying the international aspects of information exchange.

The Smithsonian Institution Libraries offer a unique setting for research, standing ready to serve as a laboratory and workshop for the design and test of experiments in an ongoing enterprise. Cooperative arrangements with other departments of the Smithsonian Institution involved in information system design and development can be negotiated to extend the vista of the researcher to include the widest possible variety of information center activities for study. Typical of these other activities are the catalog of American portraits under development by the National Portrait Gallery and the biological and mineralogical data project for inventory and information exchange being developed for the collections of objects and specimens in the Museum of National History.

Research Staff

RUSSELL SHANK, Director; Seminar Associate, Columbia University. 1946: B.S., Washington; 1949: B.A., Washington; 1952: M.B.A., Wisconsin; 1966: D.L.S., Columbia; Adjunct Lecturer, School of Library and Information Services, University of Maryland; 1953–1959: Engineering-Physical Sciences Librarian, Columbia University; 1959–1964: Assistant University Librarian and Lecturer in Librarianship, University of California, Berkeley; 1964–1967: Senior Lecturer and Associate Professor, School of Library Service, Columbia University. Specialties: communication of scientific information, information systems management; organization and governance of regional library service. Instrumentation and techniques: Bibliographical research, contact analysis. Book: *Regional Access to Scientific and Technical Information*: a Program for Action in the New York Metropolitan Area (1968). Article: "Automation in Design for Change," *Missouri Library Association Quarterly* (1969).

JACK GOODWIN, Librarian, Museum of History and Technology Branch Library. 1950: A.B., College of William and Mary; 1950–1951: Audio-Visual Librarian, College of William and Mary; 1954–1958: Reference Librarian, United States Department of Agriculture. Specialty: history of technology. Current research on history of technology; history of federal libraries. Articles: "Current Bibliography of the History of Technology," *Technology and Culture* (1964); "The Trade Literature Collection of the Smithsonian Library", *Special Libraries,* (1966).

MARY A. HUFFER, Assistant Director. 1952: A.B., Trinity; 1952–1955: School of Law, Georgetown; currently doing graduate work in library science at Catholic University. Specialties: library administration, including budgeting, cost accounting, and equipment and supply standards; computer applications to libraries; information transfer; network systems. Speaks French.

JEAN CHANDLER SMITH, Special Assistant to the Director of Libraries for Biological Science Programs. 1939: A.B., Bryn Mawr; 1953: M.S., Yale; 1956–1959: graduate work in library science at Catholic; 1947–1958: Assistant Librarian and Research Assistant, Yale University Library; 1959–1963: Acting Chief of Acquisitions and Reference Librarian, National Institutes of Health Library; 1963–1965: Chief, Reference Service Branch, Department of the Interior Library; 1965–1967: Assistant Director for Readers Services, Smithsonian Institution Libraries. Specialties: bibliography in the biological sciences, collection development. Article: "Bibliography on the Metabolism of Endoparasites Exclusive of Arthropods," *Experimental Parasitology* (1965). "Bibliography on the Biochemistry of Endoparasites," *Experimental Parasitology* (1968). Speaks French, Spanish.

WILLIAM WALKER, Librarian, NCFA and NGP Library. 1953: B.A., Iowa State; 1958: M.S.L.S., Graduate School of Library Service, Rutgers; 1957–1959: Reference Librarian and Cataloguer, Metropolitan Museum of Art; 1959–1964: Librarian, Art Reference Library, Brooklyn Museum. Specialty: bibliography of American and contemporary art; currently collaborating with Library of Congress (Subject Cataloging Division) in revision of their Library Classification Schedule on Fine Arts [Class "N"] which will lead to a new edition, to be published by the Library of Congress. Article: "Another Part of the Iceberg: Art Library Resources in the Smithsonian Institution" (1967). Speaks French.

INFORMATION SYSTEMS DIVISION

NICHOLAS J. SUSZYNSKI, JR., *Director*

Objectives

Computers comprise one of the most important frontiers of science today. The science of computer technology offers one of the means whereby the storage of data accumulating throughout the museum complex may be reduced to useful information. The expanding volume of data, the increasing complexity of concepts, and the demands for rapid application of knowledge to useful ends require an increasing coordination of effort in the management of information. In recognition of these realities, the Information Systems Division dedicates itself to the development of information systems capable of handling the ever-increasing amount of data and to coordinating this data into a meaningful display of information.

The Information Systems Division offers a total dimension of information services, utilizing advanced computer systems and techniques to gather, organize, and apply information to the Smithsonian Institution's diverse needs. It also conducts research and development projects to discover new computer techniques for museum application. In a cooperative effort with historians, scientists, and researchers, the technical expertise of the staff and the computers at this facility are used to solve a variety of problems. For example, some of the systems that have been developed were for research in the fields of biology, anthropology, paleobiology, and the fine arts where time-consuming tasks of sorting, analyzing, and correlating are conducted by the computer, freeing scientists and researchers to pursue more intellectual activities based upon the information supplied by the automated processing of data.

This Division, staffed with specialists in information retrieval and indexing techniques, mathematical computation, and management information services, offers Smithsonian museologists technical assistance in systems design, programing of new systems, and maintenance of previously developed information systems. In addition, the Information Systems Division provides support to

Smithsonian administrative, curatorial, and research activities by supplying automatic data processing capabilities for business and fiscal data.

Current Activities

The Scientific Applications Section, headed by Dante Piacesi, concerns itself with mathematical, statistical, and numerical solutions. Systems have been generated by this section to fulfill the needs of various departments. Programs applying mathematical approaches were written for the Departments of Paleobiology, Vertebrate Zoology, and Anthropology to perform descriptive statistical analysis, zoogeographic analysis, multivariate analysis of variance, and data reduction of several types of biological and physical information.

The Information Storage and Retrieval Section, headed by Reginald A. Creighton, carries on a program to develop better computerized indexing and retrieving techniques. This section has perfected a system of information retrieval that provides an investigator with the ability to direct a broad spectrum of questions to a data bank consisting of records of biological and petrographic specimens and their related bibliography. It has also developed a program that provides an automated information collection and dissemination system for botanical types. The botanical types system is capable of rapidly processing large volumes of data while facilitating data validation, correction, and printing of reports on collective holdings.

The Management Information Systems Section, headed by Stanley Kovy, develops and implements financial and business applications. Some of these applications include systems to handle subscription fulfillment, mailing lists, accounting data, labor and material requirements, and a combined payroll and personnel system.

The Library Systems and Programs Maintenance Section, under the management of James Crockett, is responsible for the development and implementation of information systems for Smithsonian Libraries and for the continuous upgrading and maintenance of selected computerized systems. In its research activity, this group is concerned with automated systems for the processing of bibliographic data, and thus file organization and classification schemes are of prime interest in its investigations. Some of its recent activities involved the development of an inventory file system and a serial purchase records system for the Smithsonian Libraries. An automated bibliography was also prepared for the Flora North American Project designed to produce a concise diagnostic manual of all vascular plants north of Mexico. In addition, an automated file of cataloged portraits was developed in conjunction with the National Portrait Gallery.

In all the above, when new applications are developed, an attempt is made to implement generic systems which will be flexible enough to be of specific utility to particular requirements, yet general enough to have more than one application in the Institution.

Research Opportunities

The facilities and expertise of this Division are available to qualified investigators interested in collaborating with our staff. Each summer, the Information Systems Division participates in the Smithsonian Institution's Internship Program, offering graduate and undergraduate students an opportunity to work with the staff of a highly diversified computational facility. In addition, the Information Systems Division has a cooperative arrangement with the National Bureau of Standards to have its scientists at the Center for Computer Science and Technology act as advisors to Summer Interns and grant recipients.

Facilities

The Computer Center, headed by Roy Perry, is equipped with a Honeywell 1250 Computer with 131,000 positions of core memory, six high-speed tape transports, five disc drives (with 45 million characters of directly accessible storagae), card reader, card punch, paper tape reader, and a 950 lines per minute printer. This computer has a telecommunications access to a CDC 6400 Computer through an arrangement with the Smithsonian Astrophysical Observatory in Cambridge, Massachusetts. An IBM 360/30 Computer from the Smithsonian Science Information Exchange in Washington, D. C. and a Univac 1108 from the Center for Computer Science and Technology at the National Bureau of Standards are available for applications requiring these capabilities.

Research Staff

NICHOLAS J. SUSZYNSKI Jr., Director, Smithsonian Information Systems. B.S.I.E., Syracuse; 1956–1957: Programmer, Sylvania Corp.; 1957–1958: Computer Analyst, UNIVAC; 1958–1960: Supervisor of Programing, Minnesota Highway Department; 1960–1965: Manager, Analysis and Programing, General Electric Co. Specialties: management of computational facilities, information technology and systems engineering. Current research on "Information utility" as a multicomputer teleprocessing and multiprograming environment. Instrumentation and Techniques: Computation, data processing, or systems design. Article: "Telecommunication and an On-line Access to Computers," Symposium on Information Problems in Natural Sciences, Mexico City (1967). "Uses of Simulation, and Introduction to Simulating the Operation of Guidance Command Generator on the General Purpose Computer," *Remington Rand Univac, St. Paul, Minnesota* (1958); with R. N. Remund, "Nike Zeus Auto-Coding Systems, Preliminary Description," *Remington Rand Univac, St. Paul, Minnesota* (1958); with R.

N. Remund, "Preliminary Programming Handbook for Nike Zeus Autocoding System," *Remington Rand Univac, St. Paul, Minnesota* (1958); "Telecommunication and an On–line Access to Computers," *Symposium on Information Problems, Natural Sciences, Mexico City* (1967); "Location Planning for Data Processing Facility," *Data Processing* (1968); "Recent Advances in Source Data Qutomation" *Symposium on Advances in Data Processing for Biology and Geology, Cambridge, England.* Author and co-author of computerized systems for simulation of computers, bridge and roadway design, integrated manufacturing information systems, real time command system, data reduction, numerical control of machine tools, and management information systems. Speaks Polish, Russian.

H. R. J. GROSCH, Director, Center for Computer Sciences and Technology, National Bureau of Standards. 1938: B.S., Michigan; 1942; Ph.D., Michigan; 1945-1950: Director of Computing, Watson Scientific Computing Laboratory; 1950–1951: Manager, Washington Technical Computing Bureau, I.B.M.; 1951–1952: Head, Logical Design Research, Digital Computer Laboratory, Massachusetts Institute of Technology; 1952–1956: Manager of Computations, Aircraft Engines, General Electric Co.; 1956–1957: Manager of Applications, Computer Department, General Electric Co.; 1958–1959: Manager, Space Program, I.B.M.; 1959–1964: consultant in U.S. and Western Europe; 1965–1966: Manager, DEACON Project, General Electric Co. Specialty: organization and management of large computer facilities; current research on computer standards and more efficient federal application of computer technology. Fieldwork: Western Europe. Formerly Contributing Editor, DATAMATION. Speaks French.

REGINALD A CREIGHTON, Manager, Information Storage and Retrieval Projects. 1958: B.S. (business administration), Mt. St. Mary's; also graduate studies in mathematics and psychology; pursuing Master's in political science at Oklahoma University. 1950–1960: systems analyst-programer; 1960–1964: Systems Analyst-Programer, General Electric Co., Information Services Operation; 1965: Operations Chief, G.S.A., Region 3; 1966: independent consultant on ISR problems. Specialties: systems analysis, information retrieval; current research on mathematical representation of information content. Articles: "Computerized System for Telemetry Simulation," "Integrated Real-Time Disaster Warning Systems," "Satellite-in-Flight Information Retrieval," classified publications, U.S. Air Force; "Retrieval Program Generation," presented ACM SIG-BDP, Washington, D. C. (1966); "An Information Storage and Retrieval System for Biological and Geological Data-Design Consideration," Symposium on Information Problems in Natural Sciences, Mexico City (1967); "The Smithsonian Institution's Information Retrieval (SIIR) System for Biological and Petrographic Data," *Proceedings of the 6th Annual National Colloquium on Information Retrieval* (1969); co-author, "An Approach to Geography Problems in Museums," ibid.(1969). Speaks Spanish.

JAMES J. CROCKETT, Manager, Library Systems and Programs Maintenance. Studied mathematics at University of Maryland; 1956–1959: tabulation project planner, Central Intelligence Agency; 1959–1966: Senior Systems Programer, Naval Ordnance Laboratory; 1966–1968: Program Analyst, Smithsonian Institution. Specialty: systems design and programing; current research on analysis and programing to support all library and bibliography oriented projects. Article: co-author, "An Automated Bibliography for the Flora of North America," Symposium of Information Problems in Natural Sciences, Mexico City (1967). Author of computerized systems for wind tunnel data reduction, mine response ranging, and retrieval systems for Naval Ordnance Laboratory.

STANLEY A. KOVY, Manager, Management Information Systems. 1958: B.S. (business admininstration), Scranton; also graduate studies in Management Information Systems; 1962–1963: Systems Analyst-Programmer, Special Projects, Edgewood Arsenal;1964: Chief, Research, Development, and Technology Branch, Army Material Command; 1965–1967: Chief, Programming Division, Army Material Command. Specialty: systems engineering in personnel, finance, supply, automatic data processing, management. Author of computerized systems for an automated personnel placement system, real property accounting and industrial fund accounting standards for data processing activities.

DANTE PIACESI Jr.,Manager, Scientific Applications Section. 1958: B.S. (mathematics and physics), Geneva College; also graduate studies in physics at Catholic U.; 1958–1967: Research Physicist, Naval Ordnance Laboratory. Specialties: explosion hydrodynamics, scientific computer applications. Articles and papers: with H. M. Sternberg, "The Application of the 'q' Method to the Light Gas Hypervelocity Gun Problems," *Fifth Hypervelocity Impact Symposium, Denver* (1961); with H. M. Sternberg, "Interaction of Oblique Detonation Waves with Iron," *Phys. Fluids 9, 1307* (1966); with D. J. Pastine, "The Existence and Implication of Curvature in the Relation Between Shock and Particle Velocities for Metals," *J.Phys.Chem. Solids 27, 1783-92* (1966); The Applications of Hydrodynamic Computer Programs to Ordnance Problems," American Ordnance Association Meeting, Naval Ordnance Test Station, Cal. (1966). Patents: with H. M. Sternberg, H. Katz, "Two Stage Guided Missile Warhead," Navy Case No. 38,654; with H. M. Sternberg, "Configuration to Increase the Efficiency of Underwater Detonations," Navy Case No. 40,814/D–3425; with V. J. Menichelli, "Staged High Explosive Delay," Navy Case No. 45,003; with R. A. Creighton, "An Approach to Georgraphy Problems in Museums," *Proceedings of the 6th Annual Colloquium in Information Retrieval* (1969).

WARREN N. MINAMI, Programer-Analyst. 1962: B.S., San Jose State 1967: M.B.A., American; currently working toward Ph.D. in computer technology and management at American; 1962–1965: Chief, Management Engineering Branch, U.S. Air Force; 1965–1966: Member, Executive Staff, Scientific and Technical Information Facility, NASA (Documentation Inc.). Specialties: systems engineering, computer applications. Co-authored systems/procedures studies of the Air Operations, Base Supply, and personnel functions, U.S. Air Force (1963–1964); designed and documented a production monitoring system in NASA's Scientific and Technical Information Facility (1965); co-authored the Pacific Ocean Bird Information Retrieval Systems, Smithsonian (1967).

SCIENCE INFORMATION EXCHANGE

MONROE E. FREEMAN, *Director*

The Science Information Exchange receives synoptic records of research in progress from all available sources, including federal agencies, many private foundations, some universities, state and city governments, and industry. The total collection of research records is now over 100,000 per annum, and there has been a substantial annual growth rate.

Objectives

The SIE's mission is to assist the planning and management of research activities supported by government and nongovernment agencies and institutions by promoting the exchange of information that concerns subject matter, distribution, level of effort, and other data pertaining to current research in the prepublication stage. It helps program directors and administrators to avoid unwarranted duplication and to determine the most advantageous distribution of research funds. It serves the entire scientific community by informing individual investigators about who is currently working on problems in their special fields.

Each research record includes the name of the supporting agency, the names of principal and associate investigators, the location of the work, the level of effort, and the dates of active work. A description (about 200 words) of the research in progress is analyzed by staff scientists, indexed, and stored in various ways to insure retrieval of all records related to any specific research element or broad topic. Any item or any combination of items can be compiled or assembled to answer a variety of questions related to research program management, specific investigator interest, or the records of all research related to a specific topic.

Comprehensive Records

Registration of unclassified research by the federal agencies is now approaching comprehensive proportions with registration including more than 95 percent of all federally sponsored research in the life, medical, biological, agricultural, and behavioral sciences, and with more than 60 percent of basic research in the physical sciences. Interest and participation by nonfederal research groups have shown a slow but steady increase, particularly in state programs in agriculture, natural resources, and conservation, a trend that will probably continue over the years for these relatively smaller and widely scattered research programs. Many associations, widely varying in scope, such as the American Sociological Society and the American Chemical Society's Petroleum Research Fund, have arranged for increased input and participation. Discussions with many others are under way.

Research Possibilities

The records are available for research and special studies along several general lines of interest. Problems related to science information services are under continuing study, such as techniques, methods, and systems for handling large numbers of records or analysis, indexing, and retrieval systems related to scientific information. Modern data processing equipment (IBM 360 computer) is available for research on a limited basis.

Services Rendered

The demand for information services has increased substantially. Especially significant has been an increasing demand from federal agencies for the retrieval and organizatiion of research records covering broad fields of national interest, such as all current research on water resources, urban projects, and oceanography, or the organization of records covering broad agency programs. These compilations,such as the *Water Resources Research Catalog,* are often published and widely disseminated by the sponsoring agency. Recognizing that the comprehensive collection of current research records serves little purpose unless used to the maximum by scientists and engineers throughout the scientific community, SIE has made increasing efforts to make these services known and available to all eligible and potential users. An increased interest in SIE has been exhibited by many foreign visitors, especially in regard to the future possibility of exchange arrangements. This has been seconded by a rising interest from American agencies whose research interests and responsibilities do not necessarily stop at international boundaries.

Current Studies

In addition to the continued effort to improve its present system, SIE is conducting a number of studies of more general relevancy to the field of information. From the vantage point of a current awareness program unique in terms of breadth of science areas covered, experience, and methods of approach, SIE professional staff members engage in the systematic study of the following problems: (1) development of an inverted subject file search system on computer disk; (2) development of a system for direct incorporation of scientists' abbreviations into computer records, without an intermediate coding step; (3) conversion of cost accounting procedures to computer-based storage and retrieval; (4) continuing evaluation of user requirements and responses; (5) development of new indexing systems for catalog publications of current research in specialized areas; (6) ongoing systems evaluation in the scientific areas: (a) quality control and reliability, (b) information yield as a function of indexing depth and index design, (c) evaluation of vocabulary requirements using frequency data for indexing and retrieval, (d) evaluation of retrieval requirements with respect to degree of scientists' review of outgoing material which is necessary (this involves identification of types of requests and questions and index categories for which material can be forwarded directly from the computer output without such review); (7) feasible approaches to automatic indexing and retrieval and to on-line subject search techniques; (8) planning of production quality, operational data bank with associated inverted files; (9) study of techniques for economically putting text into machinable form.

In one of the current studies, a comparison is made of techniques of indexing, involving such approaches as automatic computer indexing and retrieval, computer dictionary development, and optimal use of subprofessional indexing. Studies to determine relative costs and quality of product associated with manual versus machine retrieval are also in progress.

Recently completed studies include the following: (1) the use of current scientific research information for administrative purposes; (2) the evaluation of performance in retrieval by cooperative study with participating federal programs; (3) the development of selected new indexing systems for publication purposes as program management tools, also of value at the bench level; (4) the study of education and experience requirements for the recognition of scientific content and context; (5) the economics of computer storage and retrieval as part of a broader cost analysis study.

Records of research projects are available over a period of years, especially in the medical and related life sciences. In selected fields these records provide a basis for studies on general trends in research, patterns of research activity, changes in support, topical interest, and scientific personnel. The SIE staff has been actively associated with many programs involving both the scientific and data processing aspects of the information field. SIE has sought to emphasize proper scientific bases in coding and classifying the information, and it stresses the technical aspects of indexing as well as interpretive precision of retrieval.

The continual flow of new ideas and requests for information into SIE suggests that the mass of information accumulated over the years and currently available has only been partially tapped and awaits more detailed examination and exploitation.

Research Staff

MONROE E. FREEMAN, Director. 1928: B.S., Minnesota; 1929: M.S., Minnesota; 1931: Ph.D., Minnesota; 1929–1930: Instructor, University of Arizona; 1930: Instructor, University of Minnesota; 1930–1936: Assistant Professor, University of Maine; 1936–1947: Research Professional, University of Massachusetts; 1947–1953: Chief, Biochemistry, Walter Reed Army Institute of Research; 1952 - 1956: Chief, Allied Science Section, Medical Service Corps, USA; 1953-1956: Research Coordinator, Army General Staff; 1956–1960: Commanding Officer, Basic Science, ARPA, Office of the Secretary of Defense. Specialties: Research (Biological and Clinical Chemistry), Research Management Scientific Information. Articles: "Head Capacity and Bound Water in Starch Suspensions," *Arch. of Biochemistry* (1942); "Ethanolic Fractionation of Bovine Testicular Hyaluronidase," *J. Biol. Chem* (1950); "Studies on Vi Antigen II, Purification of Vi Antigen from E. Coli," *J. Immunology* (1952); "Determining Cost of Information Systems," *J. Chem. Documentation* (1964); "The Science Information Exchange: The Evolution of a Unique Information Storage Retrieval System," *Libri* (1965); "The Use of Current Scientific Research Information for Administrative Purposes," *1965 Cong. Intl. Fed. for Documentation (FID) (Abstracts)* (1965); "The Role of Science Information in the Management of Current Research," *The Chemist* (1965).

WILLIS R. FOSTER, Associate Director and Chief, Life Sciences Division. 1950: B.A., Louisiana State; 1957: M.S., M.D., Louisiana State 1950–1952: University of North Carolina; 1957–1958: George Washington; 1958–1959: Johns Hopkins; 1957–1958: Research Associate, George Washington University. Specialties: nucleic acid biochemistry, tissue culture, use of antimetabolites, ultracentrifugation of mitochondrial enzyme fractions; current research on information sciences in retrieval of medical and related life and behavioral sciences content. Instrumentation and techniques: indexing and retrieval, and information science research. Articles: with Fred G. Brazda, "Effect of Nikethamide (Coramine) on Incorporation of Radioactive Phosphate into Rat Liver Deoxypentosenucleic Acid," *Cancer Research* (1958); with D. F. Hersey, "Indexer Requirements for the Recognition of Scientific Content and Context," *1965 Cong. Intl. Fed. for Documentation (FID) (Abstracts)* (1965); with F. J. Kreysa, "A Retrieval Profile for Current Research Information," *1965 Cong. Intl. Fed. for Documentation (FID) (Abstracts)* (1965); with H. Marron, "Subject Searches on Current Research Information of Parallel Computer and Manual Files," *Proc. Am. Documentation Inst.*, vol. 4 (1966); with D. F. Hersey, contributions in "EDUNET: Report of the Summer Study of Information Networks Conducted by the Interuniversity Communications Council (EDUCOM)," edited by G. W. Brown *et al.* (1967); "Indexing Techniques and Personnel," *Technical Lit. Indexing,* American U. Tech. of Mangmt. Series (1968); "Conceptual Indexing and Retrieval of Current Research Records: An Analysis of Problems and Progress in a Large Scale Information System, "*Methods of Information in Medicine* (1968); "Determination of Acceptable Noise Levels in Subject Requests from an Information System," presented at the meeting of the American Society for Information *Science (1968).*

DAVID F. HERSEY, Deputy Director. 1947: B.S., Trinity; 1948: M.S., Illinois; 1952: Ph.D., Washington;1957–1960: Director, Department of Microbiology, 3790th U.S. Air Force Epidemiological Laboratory; 1960–1961: Member, Research Division Armed

Forces Institute of Pathology. Specialties: virology, epidemiology; current research on hepatitis virus, information processing, including indexing, storage and retrieval aspects. Articles: with S. J. Ajl, "Phosphorylation Due to the Oxidation of Succinic Acid by Cell Free Extracts of Escherichia coli," *J. Gen. Physiology* (1951); with F. M. Townsend, F. S. Wilson, "Mima polymorpha as a Causative Agent in Waterhouse Friedrichsen Syndrome," *U.S. Armed Forces Med. J.* (1954); with M. C. Colvin, C. C. Shepard, "Studies on the Serologic Diagnosis of Murine Typhus and Rocky Mountain Spotted Fever. I. Experimental Injections in Guinea Pigs and Rabbits," *J. of Immunology* (1957); with M. E. Freeman, "User Response in the Evaluation of a Flexible Indexing and Retrieval System," Am. Documentation Inst. Publ. *Automation and Scientific Communciation,* Part I (1963); with R. A. Crandell, "Cytochemical Observations on Intranuclear Inclusion of Feline Viral Rhinotracheitis Virus," *Proc. Soc. Expr. Biol. Med. (1963);* with Bill L. Long, "A Current Awareness Program for the Field of Water Resources," *1965 Cong. Intl. Fed. for Documentation (FID) (Abstracts)* (1965); with W. Hammond, "Computer Usage in the Development of a Water Resources Thesaurus," *Am. Documentation* (1967); with W. R. Foster, contributions in "EDUNET: Report of the Summer Study on Information Networks Conducted by the Interuniversity Communications Council (EDUCOM)," edited by G. W. Brown et al. (1967); with E. D. Shaw, "Viral Agents in Hepatitis," *Labs Investigation* (1968); with W. R. Foster, M. Snyderman, and F. Kreysa, "Conceptual Indexing and Retrieval of Current Research Records: An Analysis of Problems and Progress in a Large Scale Information System," *Methods of Information in Medicine* (1968).

BERNARD HUNT, Deputy Chief, Data Processing Division. 1954: B.S., Drexel Institute of Technology; 1954–1958: Staff Assistant, International Business Machines Corp., Owego, N. Y.; 1960–1961: Systems Analyst, Radio Corporation of American, Washington, D. C.; 1961–1964: Systems Project Manager, UNIVAC Division, Sperry Rand, Washington, D. C. Specialty and current research: computer applications and management of data processing activities. Article: with M. Snyderman, "Seventeen Ideas for Management of Small Computer Systems," *Journal of Data Management* (1968).

FRANK H. KRESYA, Associate Director and Chief, Physical Sciences Division. 1940: B. A., Macalester; 1943: M. A., Columbia; 1948: Ph.D., Columbia. 1947–1955: Instructor, Assistant and Associate Professor of Chemistry, St. John's University, Brooklyn; 1955–1961: Senior Chemist, Assistant to Vice President of European Developments, and Assistant to Director of Research, W. R. Grace & Co., New York and Clarksville, Md. Specialty: organic chemistry, especially nitrogen heterocyclics, reaction mechanism, and high temperature catalysis; current research on scientific information. Articles: with W.R. Foster, D. F. Hersey, and M. Snyderman, "Conceptual Indexing and Retrieval of Current Research Records: An Analysis of Problems in a Large Scale Information System," *Methods of Information in Medicine* (1968); co-author "Science Information Centers," *J. Chem. Educ.* (1966); "The Physical Sciences Division of the Science Information Exchange: A New Information Tool for the Physical Scientist, Engineer or Manager," (in press Am. Soc. Tool. Mfg. Engs.). Speaks Czech, German, French.

MARTIN SNYDERMAN, Associate Director and Chief, Data Processing Division. 1953: B.S., Carnegie Institute of Technology; 1958: M. S., Carnegie Institute of Technology; 1948–1950: Brown; 1958–1961: Programer/Analyst, Sandia Corp., Albuquerque; 1961–1962: Information Systems Officer and Data Processing Systems Analyst, Atomic Energy Commission. Specialty: computer applications: current research on managing data processing activities. Articles: with H. Marron, "Cost Distribution and Analysis in Computer Storage and Retrieval," *American Documentation (1966);* with H. Marron, "Cost Distribution and Analysis in Computer Storage and Retrieval II," *American Documentation* (1967); Anonymous (draft prepared by M. Snyderman), "Plan for an Unwanted Reward (Disaster Files)," *Business Automation* (1967); with W. R. Foster, D. F. Hersey and F. J. Kreysa, "Conceptual Indexing and Retrieval of Current Research Records: An Analysis of Problems and Progress in a Large Scale Information System," *Methods of Information in Medicine* (1968); with B. L. Hunt, "Seventeen Ideas for Management of Small Computer Systems," *Journal of Data Management* (1968); with R. A. Kline, "Job Costing a Multiprogramming Computer," *The Journal of Data Management* (1969).

ANTHROPOLOGY

INTRODUCTION

Anthropological research at the Institution consists of both cultural and biological studies, on a worldwide basis, of mankind from the earliest human beginnings. This broad and ambitious research program includes varied research projects utilizing the collections within the museums and also far-reaching field exploration and research. The relation of social biology to historical sequences, physical anthropology as the study of human development including cultural and environmental influences, paleopathology, aboriginal human ecology, and a wide spectrum of ethnological and archeological investigations including linguistics, patterns of human behavior, and cultural change constitute an intricate and highly varied research matrix. Special programs initiated in 1967 in urgent anthropology, revision of the *Handbook of North American Indians,* and ancient technology together with the other on-going research have stimulated the establishment at the Smithsonian of a new concept to further an interdisciplinary approach to global studies of man. This concept is now being realized in the Center for the Study of Man, which will permit members of the research staff, in conjunction with scientists from other academic centers, to pursue on an international basis the evolution of the human sciences as they impinge upon universal social problems.

With this considerable research and organizational capability, anthropological programs at the Institution are fertile ground for the support and stimulation of educational activity. Indeed perhaps proportionally no other research area at the Smithsonian so consistently accepts and supports both undergraduate and graduate students for research assignments and dissertation work in pursuit of academic objectives. Through the Department of Anthropology and the Center for the Study of Man opportunities for formal course work can be developed. An example of the kind of seminar which is particularly well suited to the anthropological research at the Institution is an institute being planned for the academic year 1969–1970 in the "History of Anthropology," which will offer the student participants an opportunity for in-depth exposure to the research effort of several staff members and distinctive collection resources.

In the field of Anthropology it is expected that the Office of Academic Programs will be able to offer a total of 6 Visiting Research Appointments in its programs of higher education and research training,of which full stipends may be awarded to two Visiting Postdoctoral Research Associates and two Visiting Research Associates (Ph.D. candidates).

SMITHSONIAN ANTHROPOLOGY

Department of Anthropology, National Museum of Natural History

Saul H. Riesenberg, *Chairman*

and

Center for the Study of Man

Sol Tax, *Acting Director*

Facilities

Anthropology at the Smithsonian is organized in two overlapping units, the Department of Anthropology of the National Museum of Natural History, and the Center for the Study of Man (outside the Museum). The offices and facilities of these two units are shared, however, and for purposes of research opportunities they may be treated together. The Department consists of the Divisions of North American Anthropology, Latin American Anthropology, Old World Anthropology, and Physical Anthropology. It also includes a conservation laboratory, collections processing laboratory, and a section for illustrations. Other major anthropological facilities and resources include:

1. The only set of the Human Relations Area Files in the Washington area is maintained by the Department of Anthropology. This consists of systematically classified, comprehensive primary data from the anthropological literature and from unpublished sources on about 250 ethnic or tribal groups in all parts of the world. It provides a means of rapidly securing data on specific topics for cross-cultural research. The Files are available by appointment to all qualified scholars.
2. The National Anthropological Archives (incorporating the archives of the former Bureau of American Ethnology) contain 30–40,000 individually cataloged manuscript items and some 50,000 photographs dating from 1848 to the present and dealing with languages, ethnology, history, and archeology of the American Indian. The correspondence files of the Bureau of American Ethnology from 1879 to 1950, which consist of some 100,000 letters, document these collections and serve as an important resource for research in the history of anthropology. These archives are now being expanded to have worldwide coverage, and they provide a logical repository for the results of fieldwork throughout the world and for the preservation for future anthropologists and

cultural historians of the field notes, photographs, and personal papers of anthropologists, whatever their topical or geographical specialties.

3. The archeological and ethnological collections of the Museum of Natural History comprise about one million specimens from all parts of the world. Particularly important ethnological collections represent the western United States, the Eskimo, tropical South America, the Congo, eastern and southern Asia, and the Pacific. Archeological collections are especially comprehensive for the Plains, Southwest and Southeast United States, the Arctic, and parts of Latin America. Skeletal collections are particularly extensive for the aboriginal New World and include many hundreds of known age and sex.

4. The anthropology library, which, like the other facilities, is open to properly qualified scholars, contains more than 50,000 volumes.

5. A Hrdlicka scholarship in the amount of $4,000 has been established for a graduate student or postdoctoral investigator for research training in physical anthropology. The scholarship is sustained from a memorial fund to Ales Hrdlicka (1869–1943), who founded the Division of Physical Anthropology and was its principal investigator from 1903 until his retirement in 1942. A statement of the terms of award and application blanks are available from the Office of Academic Programs.

6. The Smithsonian is among the institutions which provide facilities and assistance for holders of Wenner-Gren Foundation Museum Research Fellowships awarded on the advanced predoctoral and the postdoctoral level for research on ethnographic collections in museums, especially in conjunction with field work. Further information on these Fellowships may be obtained from the Foundation at 14 East 71st Street, New York, New York 10021.

Publications

Smithsonian scientists and occasionally those outside publish in the *Smithsonian Contributions to Anthropology*, which was started in 1965. With a much broader scope, a new format, and increased page size to present more effectively such material as illustrations, tables, and maps, the new series succeeds the Bulletins of the former Bureau of American Ethnology, which will cease with Bulletin 200.

Fieldwork

Members of the scientific staff have recently done archeological, ethnological, and physical anthropological research in Arabia, Brazil, Mexico, Greece, Jordan, Turkey, Tunisia, Burma, and Iran, as well as various parts of the United States and the Trust Territory of the Pacific Islands. This fieldwork is being extended to cover areas which are among the least-known archeologically of any part of the world, where the establishment of firm sequences of prehistoric events will be of great importance, such as Senegal. The field research makes clearer the processes by which human groups respond to, adjust to, or break down under the impact of sudden, overwhelming changes imposed from outside sources, by providing information on such processes in the cultures of various peoples subjected to changes. It permits analysis of languages, ideas, concepts, and attitudes that lie behind the more visible and material segments of both viable and rapidly disappearing cultures. It sheds light on the important problems of the beginnings of domestic plants and the domestication of sheep, goats, cattle, and hogs at archeological sites as ancient as 7900 B.C. in such seats of prehistoric beginnings of civilization as Iran and Mexico, and on the accompanying changes in health and disease (paleopathology). The intensive archeological, ethnological, and linguistic study of key areas in such regions as Middle America, through cooperative programs with botanists, zoologists, ecologists, and others, is providing far fuller and more meaningful data than have heretofore been available.

Other Programs

In view of the accelerating Westernization of the cultures of all areas of the world, the Smithsonian has initiated a cooperative program of urgent anthropology to assist in recording with scientific precision as much data as possible on the cultural variability which still exists. Never again will scientists have a chance to observe such a great range of human differences. To assist in the international effort to recover ethnological data still available, the Center for the Study of Man presently offers small grants in support of field research in urgent anthropology; these grants normally are limited to residents of the countries where the research is conducted, and they do not include funds for international travel. It is expected that this program will expand via the Smithsonian's responsibilities for administering research grants in certain foreign currencies. Smithsonian anthropologists already participate as advisors for such grants. This foreign currency program is administered by the Office of International Activities of the Smithsonian.

Another Center for the Study of Man program involves the collection and organization of data on anthropologists, anthropological institutions, and current anthropological bibliography. Of the other cooperative research programs in anthropology, perhaps the projected new handbook or encyclopedia of North American Indian cultures and history offers the most opportunities for research and educational activities by visiting students and scholars.

Various members of the anthropological staff also welcome opportunities for association with postdoctoral and predoctoral research associates and with undergraduate students, in connection with their own and the visitors' research interests.

Research Staff

SAUL H. RIESENBERG, Chairman. 1932: B.A., California, Los Angeles; 1950: Ph.D., California, Berkeley; 1949–1957: Instructor, Assistant Professor, and Associate Professor, University of Hawaii; 1953–1954: Staff Anthropologist, Trust Territory of the Pacific Islands; 1955–1956: Staff Anthropologist, Government of Samoa. Specialty: Micronesian ethnology and ethnohistory; current research on Ponapean ethnohistorical materials, and study of Puluwat native navigation and sailing. Fieldwork: Nevada, Caroline Islands, Marshall Islands, Samoa. Book: *The Native Polity of Ponape* (1968). Articles: with A.H. Gayton, "Caroline Island Belt Weaving," *Southwestern Journ. of Anth.* (1952); "A Pacific Voyager's Hoax," *Ethnohistory* (1959); with S. Kaneshiro, "A Caroline Islands Script," *Bur. of Am. Ethnology Bul. 173* (1960); "A Table of Voyages Affecting Micronesian Islands," *Oceania* (1965). Speaks German and some Ponapean, Samoan. Not in residence 1970–1971.

J. LAWRENCE ANGEL, Curator, Division of Physical Anthropology; Visiting Professor in Anatomy, School of Medicine, Howard University; Professorial Lecturer in Anthropology, School of Medicine, George Washington University; Lecturer, Division of Forensic Pathology, School of Public Health, Johns Hopkins University. 1936: B.A., Harvard; 1942: Ph.D., Harvard; 1943–1963: Professor of Anatomy and Physical Anthropology, Jefferson Medical College; 1957–1963: Consultant in Surgical Anatomy, U.S. Naval Hospital, Philadelphia. Specialties: social biology, microevolution, bone response to genetic and environmental forces, age changes, and human biological background for disease. Current research on social biology, microevolution, demography of the eastern Mediterranean in relation to historical changes from about 10,000 B.C. to the present; changes in bone structure relating to aging, disease (arthritis), and function, especially of the vertebral column, jaw joint, hip joint, etc.; changes in body build and physiology in medical students over a four-year time span. Techniques: Measuring and identification techniques for human skeletons; anthropometry. Fieldwork: Greece, Turkey, Cyprus. Book: chapter "Prehistoric Man" in *New Perspectives in World History* (1964). Articles: "Physical and Psychological Factors in Culture Growth," *Fifth Intl. Cong. of Anth. and Eth. Sciences* (1960); "Early Skeletons from Tranquility, California," *Sm. Cont. to Anth.* (1966); "Porotic Hyperostosis, Anemias, Malarias and Marshes of the Prehistoric Eastern Mediterranean," *Science* (1966). Speaks Greek, French, German.

MRS. MARGARET C. BLAKER, Archivist. 1945: B.A., Rochester; studied also at Catholic, American. Specialties: documentation, description, and retrieval of pictorial and manuscript source materials for North American Indian cultural anthropology, linguistics, and ethnohistory, and for the history of North American anthropology. Speaks Spanish.

WILLIAM H. CROCKER, Associate Curator, Division of Latin American Anthropology. 1950: B.A., Yale; 1953: M.A., Stanford; 1962: Ph.D., Wisconsin. Specialties: South American ethnology, Brazilian ethnology, Ge-speaking Indians; current research on ethnological materials of the Canela Indians. Fieldwork: Mananhao, Brazil (with the Canela Indians). Articles: "Conservatism among the Canela: An Analysis of Contributing Factors," *35th Intl. Congr. Americanists* (1962); "Extramarital Sexual Practices of the Ramkokamekra-Canela Indians: An Analysis of Socio-cultural Factors," *Volkerkundliche Abhandlunger,* 1: *Beitrage zur Volkerkunde Sudamerikas (1964);*"A preliminary Analysis of some Canela Religious Aspects," *Revista do Museu Paulista* (1965); "Ethnology: South America," *Handbook of Lat. Am. St.* (1965); "Ethnology: South America," *Handbook of Latin American Studies* (1963, 1965, 1967); "The Canela Messianic Movement: An Introduction," *Atas do Simposio a Biota Amazonica* (1967). Speaks Portuguese, Spanish, French. Not in residence fall 1970.

WILTON S. DILLON, Director of Seminars, Office of Academic Programs. B.A., University of California at Berkeley; 1951–52: Graduate study, Institute of Ethnology, University of Paris and University of Leyden; 1961: Ph.D., Columbia; 1946–49: Information Specialist, U.S. Government, Tokyo; 1952–54: Visiting Lecturer in Sociology and Anthropology, Hobart and William Smith Colleges; 1954: Staff Anthropologist, Japan Society of New York; 1954–56: Director, Clearinghouse for Research in Human Organization, Society for Applied Anthropology; 1957–63: Executive Secretary and Director of Research, Phelps-Stokes Fund of New York; 1963–69: Head of African Affairs Section, and Staff Director of Science Organization Development Board, National Academy of Sciences. Specialities: Sociology of knowledge, cross-cultural communications, gift behavior, evolution of institutions of science and technology in new societies. Fieldwork: France, Ghana, Togo. Book: *Gifts and Nations* (1968). Articles: "Universities and Nation-Building," *Journal of Modern African Studies* (1963); "Wandering African Intellectuals," *New Republic* (1963); "New Frontier Tribesmen," *Columbia University Forum* (1963); "The Flow of Ideas Between Africa and America," *Bulletin of the Atomic Scientists* (1966); "Nigeria's Two Revolutions," *Africa Report* (1966); "Science in Africa," *Encyclopedia Americana* (1968). Speaks French.

CLIFFORD EVANS, Curator, Division of Latin American Anthropology. 1941: B.A., Southern California; 1950: Ph.D., Columbia; 1949–1950: Instructor in Anthropology, University of Virginia. Specialty: South American archeology; current research on archeology of Ecuador, Amazon, Orinoco, Ponape, and Brazil, including special studies in ancient metal technology of pre-Columbian cultures of the Andean region. Fieldwork: Peru, Brazil, Guyana, Ecuador, Venezuela, Ponape, Caroline Islands, Dominica. Book: with Betty J. Meggers and Emilio Estrada, *The Early Formative Period of Coastal Ecuador: The Valdivia and Machalilla Phases* (1965). Speaks Portuguese, Spanish.

JOHN C. EWERS, Senior Ethnologist; Member, Center for the Study of Man. 1931: B.A., Dartmouth; 1934: M.A., Yale; 1935–1940: Field Curator, Museum Division, National Park Service; 1941–1944: Curator, Museum of the Plains Indian, Browning, Mont. Specialty: ethnology of the American Indians; current research on ethnohistory, arts, and material culture of the North American Indians of the Great Plains, and white artists who pictured the Indians of the American West. Fieldwork: Blackfoot Indians of Montana and Alberta, Flathead Indians of Montana and Oglala Sioux of South Dakota, Kiowa Indians of Oklahoma, Assiniboine Indians of Montana. Books: *Plains Indian Painting* (1940); *The Horse in Blackfoot Indian Culture* (1955); *The Blackfeet: Raiders on the Northwestern Plains* (1958); *Artists of the Old West* (1965); *Indian Life on the Upper Missouri* (1968);Editor, *The Indians of Texas in 1830* (1969).

GORDON D. GIBSON, Anthropologist, Division of Old World Anthropology; Member, Center for the Study of Man. 1937: B.A., Chicago; 1950: M.A., Chicago; 1952: Ph.D., Chicago; 1954: Instructor in Anthropology, University of Chicago; 1955–1958: Assistant Professor, University of Utah. Specialty: African ethnology; current research on the social organization of the southwestern Bantu; historical implications of African ethnological data. Fieldwork: investigation of the social organization of the Herero and Geiriku in Botswana (1953; 1961) and of the Himba and Herero in South-west Africa (1960–1961). Articles: "Double Descent and Its Correlates among the Herero of Ngamiland," *Am. Anthropologist* (1956); "Herero Marriage," *The Rhodes-Livingstone Inst. Journ.* (1958); "Bridewealth and Other Forms of Exchange among the Herero," *Markets in Africa* (1962); "The Himba Trumpet," *Man* (1962). Speaks German, Portuguese.

EUGENE I. KNEZ, Associate Curator, Division of Old World Anthropology. 1941: B.A., New Mexico; 1959: Ph.D., Syracuse; 1945–1946: Anthropologist (applied), National Bureau of Culture (Korea); 1949–1953: Cultural Affairs Officer and Public Affairs Officer, American embassies, Korea and Japan; 1949–59: Lecturer in anthropology, Hunter College. Specialty: cultural anthropology of Asian peoples, especially the persistence of traditional patterns of human behavior and contemporary changes in village life; current research on the sociocultural implications of village material culture as determined from the variety, degree of stability, methods of manufacture, and innovation in Korea and West Pakistan. Fieldwork: southwestern United States, Mexico, Pacific northwest coast, Saipan, South Korea, Japan, West Pakistan, India, Taiwan. Book: with C. Swanson, *A Selected and Annotated Bibliography of Korean Anthropology* (1968). Articles: "Korean Mutual Aid Groups: Persistence and Change," *Korean Rept.* (1961); "Collectors of Korean Folk Materials at the Smithsonian Institution, 1884–1966," *Korea Branch*, Royal Asiatic Society. (1969).

ROBERT M. LAUGHLIN, Associate Curator, Division of Latin American Anthropology; Member, Center of the Study of Man. 1956: B.A., Princeton; 1959: M.A., Harvard; 1963: Ph.D., Harvard; 1962–1965: Ethnologist and General Anthropologist,Bur. Amer. Ethnol., Smithsonian. Specialty: ethnology of Mesoamerica, particularly of the Mayan groups, with special interest in mythology, religion, world-view, ethnobotany, and linguistics; currently compiling a Tzotzil-English, English-Tzotzil dictionary, and doing research on the ethnography of the Tzotzil of Zinacantan, Chiapas, Mexico. Fieldwork: the Mazatec of Oaxaca, Mexico; the Tzotzil of Chiapas, Mexico. Articles: "El simbolo de la flor en la religion de Zinacantan," *Estudios de Cultura Maya* (1962); "Oficio de Tinieblas: como el Zinacanteco adivina sus suenos," *Los zinacantecos* (1966); "The Huastec," "The Tzotzil," *Ethnology of Middle America*, Vol. 7 of *Handbook of Middle American Indians* (1967). Speaks Tzotzil, Spanish, French. Not in residence 1970–1971.

LUCILE E. ST. HOYME, Associate Curator, Division of Physical Anthropology; Adjunct Professor of Anthropology, American University. 1950: B.S., George Washington; 1953: M.S., George Washington; 1963: D. Phil, Oxford; 1958–1959: Demonstrator in Physical Anthropology, Oxford; 1964: Lecturer in Anthropology, American University; 1965–1966: Associate Professorial Lecturer in Anthropology, American and George Washington Universities; 1966–1967: Lecturer in Physical Anthropology, University of Pennsylvania, and Professorial Lecturer in Anthropology, American University; 1967–present: Adjunct Professor of Anthropology, American University. Specialties:

human osteology, interpretation of variation as seen in the skull and skeleton; instrumentation and techniques; history of physical anthropology and allied fields; museum radiology. Current research on human skeletal material to learn about growth patterns, sex differences, age changes, diseases, racial variation, environmental influences, etc., with reference to primates, mammals, and other vertebrates; revision of evolutionary theory, suggesting that the action of natural selection on man is to maintain and increase variability rather than to produce populations which conform closely to regional "types." Fieldwork: North Dakota, Maryland, Jamaica.

SAM STANLEY, Program Coordinator, Center for the Study of Man. 1951: B.A., Washington; 1954: M.A., Washington; 1958: Ph.D., Chicago; 1957–1958: Visiting Lecturer in Anthropology, University of Illinois; 1960–1966: Assistant Professor and Associate Professor, California State College, Los Angeles. Specialties: North American Indians, Southeast Asia, culture change, social anthropology, action anthropology; current research on culture change, especially as related to demography of North American Indians, and the ethnology of the Tlingit Indians. Fieldwork: southeastern Alaska, Java. Articles: with Sol Tax, Robert Thomas, and Bruce Maclachlan, "The North American Indians–1950 Distribution of Descendents of the Aboriginal Population of Alaska, Canada, and the U.S.," *Map and Manuscript* (1960); with Sol Tax, "Vanishing Hunters," *Sci. Year* (1967); with William C. Sturtevant, "Indian Communities in the Eastern States," *The Indian Historian* (1968). Speaks Bahasa Indonesia.

T. DALE STEWARD, Senior Physical Anthropologist; Member, Center for the Study of Man. 1927: B.A., George Washington; 1931: M.D., Johns Hopkins; 1962–1965: Director, Museum of Natural History, Smithsonian Institution. Specialties: physical anthropology, comparative human osteology, paleopathology; current research on forensic identification, paleopathology. Fieldwork: Alaska, Guatemala, Iraq, Maryland, and Virginia. Special Techniques: Anthropometry. Articles: with John R. Groome, "The African custom of tooth mutilation in America," *Amer. Journ.* (1968); with Lawrence G. Quade, "Lesions of the frontal bone in American Indians," *Amer. Journ.* (1969).

WILLIAM C. STURTEVANT, Curator, Division of North American Anthropology; Member, Center for the Study of Man. 1949: B.A., California, Berkeley; 1955: Ph.D., Yale; 1953–1954: Research Associate, Tri-Institutional Pacific Program, Yale University; 1954–1956: Instructor in Anthropology and Assistant Curator of Anthropology, Peabody Museum, Yale University; 1956–1965: Ethnologist, Anthropologist, Bureau of American Ethnology, Smithsonian Institution; 1967–1968: Fulbright Lecturer, Institute of Social Anthropology, Oxford. Specialties: ethnology, with area emphasis on eastern North America, Burma, and 16th-century West Indies, and topical emphasis on ethnohistory, ethnoscience, linguistics, ethnobotany, and material culture; current research on the ethnology of eastern North America, especially the Seminole and Iroquois. Fieldwork: Seminole, Iroquois, and other Eastern North American Indians; Burma. Articles: "Studies in Ethnoscience," *Am. Anthropologist* (1964); "Anthropology, History, and Ethnohistory," *Int. Cul. Anth.* (1968); "History and Ethnographs of some West Indian Starches," *Dom. and Exploitation of Plants and Animals* (1969); "Does Anthropology Need Museums?," *Proc. Biol. Soc. Washington* (1969). Speaks Spanish, some French and German.

WILLIAM B. TROUSDALE, Associate Curator, Division of Old World Anthropology; Adjunct Professor of Art History and Archaeology, Columbia University. 1952: B.A., Michigan; 1956: M.A., California, Berkeley; 1967: Ph.D., Michigan; 1962–1967: Associate Curator of Chinese Art, Freer Gallery of Art. Specialties: archeology of China, Siberia, central Asia, and eastern Iran. Fieldwork: U.S.S.R., India, Pakistan, Taiwan, Iran, Afghanistan, Syria. Articles: "A Chinese Handle-bearing Mirror from Northern Afghanistan," *Atribus Asiae* (1961); "Chinese Jade at Philadelphia," *Oriental Art* (1964); "The Minaret of Jam: A Ghorid Monument in Afghanistan," *Archaeology* (1965); "Rock-Engravings from the Tang-i Tizao in Central Afghanistan," *East and West* (1965); "Chinese Jade in the Dayton Art Institute," *Oriental Art* (1968). Speaks Chinese, Russian, French, German.

GUS W. VAN BEEK, Associate Curator, Division of Old World Anthropology. 1943: B.A., Tulsa; 1945: B.D., McCormick Theological Seminary; 1953: Ph.D., Johns Hopkins; 1954–1959: Research Associate and Assistant Editor, Arabian Publication Project, Johns Hopkins University; 1960–1965: Editor, Annual of the American Schools of Oriental Research. Specialty: Near Eastern archeology, chiefly in Arabia, Syro-Palestine, and Cyprus; current research on pre-Islamic cultures of southern Arabia. Fieldwork: Wadi Beihan, Western Aden Protectorate; Tell es-Sultan (Old Testament Jericho), Jordan; Tell Dhiban (Biblical Dibon), Jordan; Qumran, Jordan; Wadi Hadhramaut, Arabia; Yemen; Axum, Ethiopia; Tunisia; Saudi Arabia. Books: *Hajar Bin Humeid: Investigations at a Pre-Islamic Site in South Arabia* (1969). Articles: "The Date of Tell Abu Huwam, Stratum III," *Bul. of the Am. Schools of Oriental Res.* (1955); "Marginally Drafted, Pecked Masonry," *Arch. Disc. in S. Arabia* (1958); "A New Interpretation of the So-Called South Arabian House Model," *Am. Journ. of Archaeology* (1959); "Frankincense and Myrrh," *Bibl. Archaeologist* (1960); with G.H. Cole and A. Jamme, "An Archeological Reconnaissance in Hadhramaut, South Arabia–A Preliminary Report," *Ann. Rept. . . . of the Sm. Inst. . . 1963* (1964); "South Arabian Archaeology and History: Developments in the Last 30 Years," *The Bibl. World* (1967); "Monuments of Axum in the Light of South Arabian Archaeology," *Journ. Amer. Oriental Soc.* (1967). Speaks Arabic and some French, German, Hebrew, Assyrian, Aramaic. Not in residence, summer 1970.

PAUL H. VOORHIS, Linguist, Division of North American Anthropology. 1961: B.A., New York; 1967: Ph.D., Yale. Specialties: linguistics, Kickapoo language; current research on the Kickapoo language. Fieldwork: Kickapoo Indians in Oklahoma and Coahuila, Mexico; Mesquakie Indians in Iowa.

WALDO R. WEDEL, Senior Archeologist; Member, Center for the Study of Man. 1930: B.A., Arizona; 1931: M.A., Nebraska; 1936: Ph.D., California, Berkeley; 1962–1964: Head Curator of Anthropology, Smithsonian Institution. Specialties: prehistory, ethnohistory, and aboriginal human ecology of the Great Plains of North America, cultural relationships and contacts between the Great Plains and Southwest in prehistoric and early historic times, and interareal relationships between the Great Plains and adjacent regions; current research on archeology and aboriginal ecology of Central and Southwestern Kansas (based on field works of 1964–1968). Fieldwork: Arizona; Nebraska; California; Missouri and Kansas; Maryland and Virginia; La Venta, Mexico; South Dakota; Wyoming; Colorado; Kansas. Books: *An Introduction to Kansas Archeology* (1959); *Prehistoric Man on the Great Plains* (1961). Articles: "Environment and Native Subsistence Economies in the Central Great Plains," *Sm. Misc. Coll.* (1941); "Some Aspects of Human Ecology in the Central Plains," *Am. Anthropologist* (1953); "The Central North American Grassland: Man-Made or Natural?" *Sci. Sci. Mon.* (1957);

"The High Plains and Their Utilization by the Indian," *Am. Antiquity* (1963); "The Council Circles of Central Kansas," *American Antiquity* (1967); "Salvage Archaeology in the Missouri River Basin," *Science* (1967); "Mummy Cave," *Science* (1968); "Some Thoughts in Central Plains–Southern Plains Archaeological Relationships," *Great Plains Journ.* (1968).

Office of Anthropology Research Associates and Collaborators:

W. Montague Cobb, Research Associate
Henry B. Collins, Archeologist Emeritus, Member, Center for the Study of Man
Wilson Duff, Research Associate
Marcus S. Goldstein, Research Associate
Sister Inez Hilger, Research Associate
C.G. Holland, Research Associate
Neil M. Judd, Research Associate Emeritus
Ralph Kepler Lewis, Research Associate
Olga Linares de Sapir, Research Associate
Betty J. Meggers, Research Associate
Philleo Nash, Research Associate
Victor Nunez Regueiro, Research Associate
Matthew W. Stirling, Archeologist Emeritus
Douglas Taylor, Research Associate
William J. Tobin, Collaborator
Theodore A. Wertime, Research Associate
William S. Wills, Jr., Research Associate
E. Wilmsen, Research Associate
Richard B. Woodbury, Research Associate
Nathalie F.S. Woodbury, Research Associate

EVOLUTIONARY AND SYSTEMATIC BIOLOGY

INTRODUCTION

Research in the evolutionary and systematic biology at the Institution is a multifaceted endeavor involving scores of research scientists working in five major subject areas: botany, entomology, invertebrate zoology, paleobiology, and vertebrate zoology. While most of the research in these areas is collection-based, field observation and laboratory analyses are also important in the process of collecting, organizing, synthesizing, and interpreting biological data. Interdisciplinary efforts are of paramount importance in researching the relationships, both phylogenetic and environmental, among the various biological groups. Taxonomy, identification, comparative morphology, distribution, anatomy, and reconstruction are forms of research which are common to all areas of investigation in this comprehensive program area. The impressive size of the collections and the diversity of staff research competence represent a broad-based capacity to respond to a wide range of student enquiry. The depth of interest and concern for educational values on the part of the professional staff is demonstrated by the number of them involved in teaching at all levels both outside the Institution and within it. It is this recognition of academic principles which, on an individual basis as well as through joint education programs and cooperative research projects, is serving to establish systematic biology in a central integrative position in museums and universities alike.

In the field of Evolutionary and Systematic Biology it is expected that the Office of Academic Programs will be able to offer a total of 25 Visiting Research Appointments in its programs of higher education and research training of which full stipends may be awarded to seven Visiting Postdoctoral Research Associates and five Visiting Research Associates Ph.D. candidates).

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NATIONAL MUSEUM OF NATURAL HISTORY

RICHARD S. COWAN, *Director*

The interests of the National Museum of National History include all aspects of the natural sciences, anthropology, botany, entomology, invertebrate zoology, mineral sciences, paleobiology, and vertebrate zoology; departments representing these subjects are listed below. The scientific program of the Museum consists of the individual interests of more than a hundred research scientists. While most of the research is collections-based, it involves field observation and refined laboratory techniques. In addition to describing natural history objects and phenomena, most of the investigations are also deeply concerned with the present and historical interrelationships of organisms, both phylogenetic and environmental. The results of the research efforts of the staff are published in the Smithsonian series and in professional journals, in the form of floras, faunas, monographs, checklists and catalogs, and in treatises on population dynamics in relation to the systematics of selected groups. The scientific staff also provides identification of organisms, rocks, minerals, and extraterrestrial particles as time and interest permit.

With the assistance of the supportive staff, the scientific staff develops and maintains the national collections of natural history objects for their own use and for biologists everywhere. While collections are shipped to researchers over the world in great numbers, biologists are encouraged to use the national collections in the Museum and adequate space and equipment is available for several researchers at a time in each department.

In addition to the seven departments comprising the Museum of Natural History, three special program Offices have been established at the Smithsonian to encourage and facilitate interdisciplinary communication and research. The programs of the Office of Systematics are described below, while those of the Offices of Ecology and Oceanography and Limnology are described on pages 162 and 177-179.

OFFICE OF SYSTEMATICS

RICHARD S. COWAN, *Acting Head*

The Office of Systematics was established early in 1965 to provide a focal point for systematic interests both within the National Museum of Natural History and outside it. Although nearly all the professional staff members engage in systematic research, interdisciplinary needs increasingly occur which can be met best by a non-discipline-oriented office. Typical of these needs are research problems requiring joint attack by several disciplines. An important responsibility of the Office is to represent systematics at all levels, to urge the incorporation of taxonomic data in otherwise nonsystematic studies, and to broaden the base of current systematics to include information from as many ancillary sources as possible.

Program

The Office continues to assist the development of the application of computer techniques to biological research and collections management. It also has supported translations of scientific literature in unfamiliar languages and provided critical research tools of various sorts.

Increasing support, however, is being provided for devices which have the effect of strengthening the position of systematics within the biological community. For example, an annual Summer Institute in Systematics is convened to present an up-to-date review of historical perspectives and modern methodologies of systematic biology. Participants are drawn from academic and research organisms across the country to discuss subjects presented by outstanding authorities in systematics and ancillary disciplines in a context which clearly emphasizes their interdependence.

Still another general concern of the Office of Systematics is to develop cooperative research programs with the Offices of Ecology and Oceanography and Limnology. These sometimes take the form of jointly-sponsored scientific meetings but may also involve joint support of broad, interdisciplinary research projects.

Listings of the Museum of Natural History Departments disclose that every aspect of taxonomy is under active investigation within the Smithsonian.

A scholarship for students pursuing dissertation research or postdoctoral investigators is awarded each year for projects which include the collecting of fauna outside the continental United States. The Walter Rathbone Bacon Scholarship, for $6,000, is awarded shortly after the first of the year to a highly qualified applicant whose project in systematic zoology is judged most likely to contribute to his education or professional advancement, and to the science of systematic zoology. A statement of the terms of the award and application forms are available from the Office of Academic Programs.

Research Staff

RICHARD S. COWAN, Director, National Museum of Natural History, 1942: A.B.; Wabash; 1948: M.S., Hawaii; 1952: Ph.D., Columbia; 1946–1948: Teaching Assistant, Department of Botany, University of Hawaii; 1948–1952: Technical Assistant, New York Botanical Garden; 1952–1957: Assistant Curator, New York Botanical Garden. Specialty: systematic botany. Fieldwork: Marshall Islands, 1946; Lost World Mountains, Venezuela, 1950–1951; Brazil and Guianas, 1954–1955; West Indies, 1959; British

Guiana, 1962; Baja California, 1963. Articles: "Leguminosae and Rutacae" in *The Botany of the Guayana Highland–III, Memoirs of the New York Botanical Garden* (1958); "Rutaceae" in *The Botany of the Guayana Highland–IV, Memoirs of the New York Botanical Garden* (1960); "Rutaceae of Santa Catarina," *Sellowia* (1960); "Leguminosae: The Botany of the Guayana Highland," *Memoirs of the New York Botanical Garden* (1961); "Studies in Tropical American Leguminosae–V", *Boletin de la Sociedad Venezolana de Ciencias Naturales* (1961); "Studies in Tropical American Leguminosae–VI," ibid (1963); "The Identity of *Calliandra haematocephala* and *C. inaequilatera,*" *Baileya* (1963); "Botanical Nomenclature, Punched Cards, and Machines," *Taxon (1963);* "A New Genus of the Leguminosae (Caesalpinoideae)," *Rhodora* (1966); "Rutaceae of the Guayana Highland," *Memoirs of the New York Botanical Garden* (1967); "Rutaceae in Flora of Guyana," *Memoirs of the New York Botanical Garden* (1967); *"Swartzia* (Leguminosae, Caesalpinioideae Swartzieae)," *Flora Neotropica Monograph (1968).*

DEPARTMENT OF BOTANY

Research in the Department of Botany is concerned with plant systematics in the broadest sense: taxonomy, identification, and nomenclature; investigations in comparative anatomy and morphology; cytology; palynology; phytogeography; ecology; and economic botany. Most studies are aimed at elucidating evolutionary development and phylogeny, and the broad questions of classification receive central consideration. Both modern and fossil species of many plant groups, including the algae, fungi, mosses, and lichens, are being studied.

Collections

The United States National Herbarium is a quasi-official organization now administered by the Department as its chief facility. Its worldwide collections include more than 3 million dried plant specimens distributed among the Divisions approximately as follows: phanerogams, 2,000,000; ferns, 240,000; grasses, 400,000; cryptogams, 500,000. The Division of Plant Anatomy maintains 35,500 wood specimens, 3,400 microscope slides of wood sections, and 5,000 pollen slides.

The collections are especially rich in New World specimens, particularly from South America; but Asia, Africa, Australia, and the Pacific Islands are also represented. The extremely important segregated Type Herbarium, including numerous New World holotypes and isotypes, contains about 60,000 specimens: 42,000 phanerogams, 10,000 grasses, 3,500 ferns and 4,500 cryptogams. Mycological collections of the Department, with 675,000 specimens covering all groups of fungi, are maintained separately with the National Fungus Collections, a branch of the U.S. Department of Agriculture, in Beltsville, Maryland.

The Department is located within reach of both the National Arboretum, where a large collection of horticulturally important species is maintained, and the U.S. Forest Service Herbarium. The Arctic plant collections at Catholic University are available for consultation and research. These combined collections add another half-million specimens to the resources available for study.

Plant specimens are made available to the botanical community on loan, and 350,000 specimens have been borrowed since 1949. Well over a quarter million herbarium specimens have been sent during the same period from the U.S. National Herbarium on exchange to institutions throughout the world.

Facilities

A microtechnical laboratory is maintained for the use of staff and a limited number of visitors. Equipment is at hand for pollen acetolysis and statistical studies. Paleobotanical laboratories and equipment can be used through arrangements in effect with the Division of Paleobotany. Study areas and a Department conference and seminar room are available for visiting scientists.

One of the outstanding facilities of the Department is the Hitchcock-Chase Agrostological Library of literature on grasses built up over many years. This library complements the great collection of grass specimens, which is without question the finest in the United States and ranks with the best in the world. The John A. Stevenson Mycological Library, probably the most complete collection of its kind in the United States, is kept with the National Fungus Collections but is owned by the Smithsonian Institution and is a part of the library holdings of the Department. The Departmental library, including the John Donnell Smith Botanical Library, is rich in original editions of classical botanical works.

Fieldwork

Through the years the Department has carried out a program of field research in the American tropics and also numerous shorter collecting trips on the North American continent. Currently, the Smithsonian is engaged in a biological survey of the West Indian island of Dominica, where the Department of Botany is responsible for the botanical aspects of the study. An ecological field station on Chesapeake Bay benefits the Department by providing additional opportunities for autecological and phytosociological research.

From year to year a limited number of opportunities arise for professional botanists and students to participate in Smithsonian field expeditions. An increasing number of such expeditions to both the Arctic and the tropics is likely to be organized in the next few years, and inquiries for participation are invited. It is, however, more often possible to arrange to receive ctyological, anatomical, or other material from these expeditions than actually to accompany them.

Publications

Since 1892 many of the results of research undertaken in conjunction with the specimens in the U.S. National Herbarium have been published in the *Contributions from the U.S. National Herbarium.* A major source of floristic and monographic data, the *Contributions* now number 38 volumes and comprise a storehouse of botanical taxonomy especially rich in works on New World plants.

The production of the Index Nominum Genericorum, a project of the International Association for Plant Taxonomy, has been transferred from Utrecht, the Netherlands, to the United States. Funded by the National Science Foundation on a grant to the Association, the continuing project is housed in the Smithsonian Department of Botany, where headquarters facilities have been provided for the staff of botanical bibliographers.

Research and Education

Space is regularly available in the U.S. National Herbarium for six to eight investigators attached to the New Crops Research Branch, Agricultural Research Service, U.S. Department of Agriculture. Facilities are also used by botanists from the Forest Service, the National Arboretum, and the National Park Service who come to consult the plant specimens and library and confer with the staff. Throughout the existence of the U.S. National Herbarium facilities have been afforded in Washington to visiting botanists from throughout the world for purposes of study and comparison.

For the trained investigator the range of possibilities is wide, and the Department is anxious to make its facilities available to those who, by their special competence in plant anatomy, cytology, genetics, statistics or biochemical taxonomy, might be able to enter into fruitful collaboration with one or more members of the staff. Programs of study for students are necessarily restricted more or less by the students' own backgrounds and the special competences of the staff members with whom they propose to work.

The Department is best equipped to offer research opportunities centering on the use of its large herbarium collections. The educational value of the herbarium specimens themselves in providing essential support for the theses of students in systematic botany is difficult to estimate. It is a safe assumption, however, that there is no serious research of any scope which can be executed in systematic botany in the United States without some recourse to the plant specimens of the U.S. National Herbarium. Specimens are made available to students for thesis work through loans to their academic advisors; students are also encouraged to visit the National Herbarium personally and to avail themselves of the collections and the advice and counsel of our staff members. For students associated with the smaller university herbaria, a visit to the great collections of the U.S. National Herbarium is an educational experience in itself. By adequate advance arrangement, however, it is possible for students to cooperate with other Departments of the Smithsonian or other agencies of the government and to conduct studies in plant ecology, conservation, ethnobotany, and paleobotany.

Over the years, through cooperative arrangements with nearby universities, Department staff members have acted as advisors to graduate students in botany. Staff members have also presented courses in plant systematics at the U.S. Department of Agriculture Graduate School in Washington. Each summer the Department of Botany participates in the Institutions's internship program. The opportunity has thereby been afforded many graduate students in botany to become familiar with the working of a large herbarium and the actual research techniques employed by systematic botanists.

An informal departmental seminar is held monthly from October to May each year to discuss current botanical research not only of the Smithsonian staff but also of botanists employed by the U.S. Department of Agriculture, the U.S. Geological Survey, other government agencies, and universities. When possible, visiting botanists are called upon to speak. Staff members regularly attend national and international scientific meetings; and this, added to the steady stream of professional visitors who come to study collections and consult or work with the staff, tends to give the Department of Botany a vital and cosmopolitan atmosphere.

Research Staff

W. ANDREW ARCHER, Research Associate. 1920: B.S., New Mexico State College; 1925: Ph.D., Michigan; 1942–1946; Botanist, Office of Foreign Agriculture Relations, U.S. Department of Agriculture; 1946–1964: Botanist and Plant Taxonomist, U.S. National Arboretum. Specialties: economic botany, botanical explorations, history of botany, archives; herbarium techniques. Fieldwork: Nevada, Missouri, Iowa, West Virginia, New Mexico, Ohio; Colombia, Brazil, Ethiopia, Peru, Ecuador. Articles: "Plant Diseases in Missouri," *Mo. Expt. Sta. Bul.* (1926); "Diseases of Fruit and Nut Crops in the United States in 1926," *Plant Disease Reporter* (1927); "Medical Uses of Plants by Indian Tribes of Nevada," *Cont. Flora Nevada* (1957); "Adolpho Ducke, Botanist of the Brazilian Amazon (1876–1959)," *Taxon* (1962). Speaks Spanish.

EDWARD S. AYENSU, Associate Curator, Division of Plant Anatomy. 1961: B.A., Miami; 1963: M.Sc., George Washington; 1966: Ph.D., London; 1966: Fellow, Linnean Society of London. Specialty: comparative anatomy and phylogeny of angiosperms; current research on anatomy of the Monocotyledons, especially Dioscoreaceae, Trichopodaceae, Stinomeridaceae, Stemonaceae (Roxburghiaceae), Petermanniaceae, Velloziaceae. Fieldwork: Ghana, Panama, England, Dominica, Togo. Articles: with A. C. Smith, "The Identity of the Genus *Calyptosepalum* S. Moore," *Brittonia* (1964); with W. L. Stern, "Systematic Anatomy and Ontogeny of the Stem in Passifloraceae," *Cont. U.S. Nat. Herb. (1964);* "Notes on the Anatomy of the Dioscoreaceae," *Ghana Jour. Sci.* (1965);

"Taxonomic Status of *Trichopus:* Anatomical Evidence," *Journ. Linn. Soc.* (Bot.) (1966); "The Anatomy of Barbaceniopsis a new Genus Recently Described in the Vellobiaceae," *Amer. Journ. Bot.* (1968); "Leaf Anatomy and Systematics of Old World Velloziaceae," *Kew Bul.* (1968); with P. B. Tomlinson, "Notes on the Vegative Morphology and Anatomy of Petermanniaceae," *Proc. Linn. Soc.* (1968). Speaks Fanti.

PAUL S. CONGER, Botanist Emeritus. 1920: B.S., Wisconsin; 1921: M.S., Wisconsin; 1921–1922; Aid, Division of Marine Invertebrates, U.S. National Museum; 1942–1943; Assistant and Research Associate, Carnegie Institution of Washington, and Custodian of Diatoms, U.S. National Museum; 1943–1967; Associate Curator (in charge of Diatoms), U.S. National Museum. Specialty: taxonomy, morphology, and ecology of Diatoms, with relationships to limnology and oceeanography. Fieldwork: Cape Cod–Buzzard's Bay area; Dry Tortugas and adjacent Florida Key area; Chesapeake Bay area; northern Wisconsin lake region. Articles: "Significance of Shell Structure in Diatoms," *Ann. Rpt. Sm. Inst.* (1936); "Origin and Utilization of Diatomaceous Peat Deposits," *Sc. Monthly* (1939); "Accumulation of Diatomaceous Deposits," *Journ. Sedimentary Petrology* (1942); "Diatoms: Their Most Important Role," *Sc. Monthly* (1951); "A New Genus and Species of Plankton Diatom from the Florida Straits," *Sm. Mics. Coll.* (1954).

JOSE CUATRECASAS, Research Associate, and National Science Foundation Investigator. 1923: Pharm. Lic., Barcelona; 1927: University of Geneva; 1928: Dr. Pharm., Madrid; 1930–1934: Berlin–Dahlem; 1931–1939; Professor, University of Madrid; 1939–1942: Professor, Instituto Botanico, Universidad Nacional de Colombia; 1943–1947: Director, Comisión Botánica del Valle, and Professor, Faculdad de Agronomía del Valle Cali, Colombia; 1947–1950: Curator of Colombian Botany, Chicago Natural History Museum. Specialty: taxonomy of neotropical phanerogams and flora of Colombia, Andean Compositae. Fieldwork: Colombia, Brazil, Venezuelan Paramos. Current research: Fieldwork in the tropics. Articles: "A Taxonomic Revision of the Humiriaceae," *Cont. U.S. Nat. Herb.* (1961); "Studies in South American Plants, VI," *Brittonia* (1962); "Cacao and Its Allies: A Taxonomic Revision of the Genus *Theobroma,*" *Cont. U.S. Nat. Herb.* (1964); "Miscelánea sobre Flora Neotropica, I," *Ciencia (1964);* "Studies on Andean Compositae–VI," *Proc. Bio. Soc. Washington* (1964); "Observaciones Geobotanicas en Colombia," *Trab. Mus. N. Cienc. Nat. Bot.* (1934); "Notas Flora Colombia I–XIV," *Rev. Acad. Colomb. Cienc.* (1940–1956); "Synopsis der Gattung Loricaria," *Feddes Report.* 56:149–172 (1954); "Aspectos de la Vegetación Natural de Colombia," *Rev. Acad. Colomb. Cienc.* 10 (1958); "Prima Flora Colombiana," *Webbia* (I, 1957; II, 1958); "Studies in South American Plants VI," *Brittonia* (1962); "Paramo Vegetation and its Life Forms," *Colloquium Geographicum* (1968). Speaks Spanish, German, Catalan, French.

WALLACE ROY ERNST, Associate Curator, Division of Phanerogams; Professor of Botany (in absentia), University of Kansas, Lawrence. 1950: B.A., California, Los Angeles; 1953: M.A., Californa, Los Angeles; 1962: Ph.D., Stanford; 1961–1963: Botanist, Arnold Arboretum and Gray Herbarium, Harvard University. Specialties: taxonomy, floral morphology, and cytology, especially of Papaveraceae, Fumariaceae, Capparaceae, Loasaceae. Fieldwork: western U.S.; Baja California, Mexico, and adjacent islands; Oaxaco, Mexico; Dominica; Morocco. Articles: "The Genera of Papaveraceae and Fumariaceae in the Southeastern United States," *Journ. Arnold Arb.* (1962); "The Genera of Hamamelidaceae and Platanaceae in the Southeastern United States," *Journ. Arnold Arb.* (1963); with H. J. Thompson, "The Loascaceae in the Southeastern United States," *Journ. Arnold Arb.* (1963); "The Genera of Capparaceae and Moringaceae in the

Southeastern United States," *Journ. Arnold Arb.* (1963); "The Genera of Berberidaceae, Lardizabalaceae, and Menispermaceae in the Southeastern United States," *Journ. Arnold Arb.* (1964); with H. J. Thompson, "Floral Biology and Systematics of Eucnide (Loasaceae)," *Journ. Arnold Arb.* (1967); "Floral Morphology and Systematics of *Platystemon* and its Allies *Hesperomecon* and *Meconella* (Papaveraceae, Platystemonoideae)," *Univ. Kans. Sci. Bul.* (1967).

RICHARD HUSTED EYDE, Associate Curator, Division of Plant Anatomy. 1956: B.S., Franklin and Marshall; 1957: M.S., Ohio State; 1962: Ph.D., Harvard. Specialty: comparative anatomy of flowers and of fossil and modern fruits. Fieldwork: India, Panama. Articles: "Morphological and Paleobotanical Studies of the Nyssaceae, I. A Survey of the Modern Species and Their Fruits," *Journ. Arnold Arb.* (1963); with E. S. Barghoorn, "Morphological and Paleobotanical Studies of the Nyssaceae,II. The Fossil Record," *Journ. Arnold Arb.* (1963); "Inferior Ovary and Generic Affinities of *Garrya*," *Am. Journ. Bot.* (1964); "The Nyssaceae in the Southeastern United States," *Journ. Arnold Arb.* (1966); "Systematic Anatomy of the Flower and Fruit of *Corokia*," *Amer. Journ. Bot.* (1966).

F. RAYMOND FOSBERG, Special Advisor on Tropical Biology to the Director of the Museum of Natural History; member, affiliate graduate faculty, University of Hawaii, 1930: B.A., Pomona; 1935: M.S., Hawaii; 1939: Ph.D., Pennsylvania; 1949–1950; Research Associate, Catholic University of America; 1951–1966: Botanist, U.S. Geological Survey. Specialties: flora of the Pacific Basin Islands; taxonomy of certain groups of Rubiaceae; all aspects of coral islands; nature and distribution of tropical vegetation; nature of ecosystems, especially island ecosystems. Current research on flora of Micronesia, flora and ecology of the coral islands. Fieldwork: Pacific Islands, Andean South America, Southeast Asia and East Indies, Caribbean area, Indian Ocean area, West Africa, Mexico and Central America, California and southwestern United States, eastern United States, northwestern Europe. Books: *The Genus Gouldia (Rubiaceae)*,, B. P. Bishop Museum Bulletin no. 174 (1937); *Polynesian Species of Hedyotis (Rubiaceae)*, B. P. Bishop Museum Bulletin no. 174 (1943); with M.–H. Sachet, *Island Biographies*, National Academy of Sciences (1955); with M.–H. Sachet, *Manual for Tropical Herbaria*, UNESCO Intl. Bur. for Plant Taxonomy and Nomenclature (1965). Articles: with H. E. Moore, "The Palms of Micronesia and the Bonin Islands," *Gentes Herbarum* (1956); "Studies in Pacific Rubiaceae: V. The Hawaiian Species of *Psychotria*," *Brittonia* (1964).

MASON E. HALE, JR., Curator, Division of Cryptogams. 1950: B.S., Yale; 1952: Ph.D., Wisconsin; 1950: Assistant Botanist, Arctic Institute of America expedition to Baffin Island; 1953–1955: Assistant Professor, University of Wichita; 1955–1957: Assistant Professor, University of West Virginia. Specialty: taxonomy and chemistry of lichens. Fieldwork: Arctic America, Mexico, the Philippines, Malaysia, Japan, Hawaii. Books: *Lichen Handbook* (1961); *The Biology of Lichens* (1967); *How to Know the Lichens* (1969). Articles: "Lichens from Baffin Island," *Amer. Midl. Nat.* (1964); with S. Kurokawa, "Studies on *Parmelia* Subgenus *Parmelia*," *Cont. U.S. Nat. Herb.* (1964); "A Monograph of *Parmelia* Subgenus *Amphigymnia*," *Cont. U.S. Nat. Herb.* (1965). Speaks Japanese.

DAVID B. LELLINGER, Associate Curator, Division of Ferns. 1958: B.A., Illinois; 1960: M.S., Michigan; 1965: Ph.D., Michigan. Specialties: taxonomy of pteridophytes, especially those of the New World tropics; taxiometrics, in particular neotypological and evolutionary methods. Fieldwork: southwestern United States, Dominica, Costa Rica. Articles: with C. V. Morton, "The Polypodiaceae Subfamily Asplenioideae in Venezuela," *Mem. N.Y. Bot. Gard.* (1966); "A Revision of the Fern Genus *Mildella,*" *Amer. Fern J.* (1967); *"Pterozonium"* in "The Botany of the Guayana Highland," *Mem. N.Y. Bot. Gard.* (1967).

FLOYD A. MCCLURE, Research Associate. 1918: B.A., Ohio State; 1919: B.S., Ohio State; 1928: M.S., Ohio State; 1935: Ph.D., Ohio State; 1919–1943: Professor and Curator of Economic Botany, Lingnan University, Canton, China; 1944–1954: Consultant on Bamboo, Office of Foreign Agricultural Relations, U.S. Department of Agriculture; 1956–1959: Consultant in Tropical Forestry, Maria Moors Cabot Foundation, Harvard University. Specialties: propagation, utilization, documentation and taxonomy of bamboos. Fieldwork: eight provinces of China, island of Hainan; Philippines; Tonkin; North Vietnam, Hong Kong and the New Territories; Mexico, Central America; South America; West Indies. Book: *The Bamboos* (1966). Articles: "Toward a Fuller Description of the Bambusoideae (Gramineae)," *Kew Bull.* (1961); "Typification of the Genera of the Bambusoideae IV," *Taxon* (1962); "A New Feature in Bamboo Rhizome Anatomy," *Rhodora* (1963); "Bambusoideae" in "The Botany of the Guayana Highland. Part V," *Mem. N.Y. Bot. Gard.* (1964); "Bamboos" in "Manual for Tropical Herbaria," *Regn. Veg.* (1965).

CONRAD V. MORTON, Curator, Division of Ferns. 1928: B.A., California. Specialty: taxonomy of ferns of the world and of New World Gesneriaceae and Solanaceae. Fieldwork: North America, West Indies, Central America. Articles: "Observations of Cultivated Ferns. VI. The Ferns Currently known as *Rumohra,*" *Am. Fern. Journ.* (1960); "Pteridophyta," *Rpt. on Bot Excursion to the Boreal Forest Region in Northern Quebec and Ontario,* Dept. Northern Affairs and National Resources, Canada (1962); "A Reexamination of Mexican *Smilax* (Smilacaceae)," *Brittonia* (1962); "Gesneriaceae" in "Botanical Novelties in the Region of Sierra de Lema, "Estado Bolivar–I" *Bol. Soc. Venez. Cienc. Nat.* (1962); "A New Species of *Achimenes,* Section *Dicyrta,*" *Baileya* (1962); "A Revision of *Trichanta* (Gesneriaceae)", *Cont. U.S. Nat. Herb.* (1963); "The Genus Grammitis in Ecuador," *Cont. U.S. Nat. Herb.* (1967); "Studies of Fern Types, I," *Cont. U.S. Nat. Herb.* (1967).

DAN H. NICOLSON, Associate Curator, Division of Phanerogams. 1955: B.A., Grinnell; 1957: M.B.A., Stanford; 1959: M.S. Cornell; 1964: Ph.D., Cornell. Specialties: taxonomy and comparative anatomy of Araceae, dicot flora of Dominica. Fieldwork: Philippines, Indonesia, Malaysia, New Guinea, Thailand, Dominica, Nepal, and India. Current research on Dominica, southern India. Articles: "The Geographic Location of *Gorgonidium* (Araceae)," *Rhodora* (1963); "Collecting Araceae" in "Manual for Tropical Herbaria," *Regn. Veg.* (1965); *"Filarum,* a new. genus of Peruvian Araceae," *Brittonia* (1966); "Selection of Lectotype Species for Genera of the Family Araceae," *Taxon* (1967); "A Revision of *Amydrium* (Araceae)," *Blumea,* (1968).

KITTIE FENLEY PARKER, Research Associate; Associate Professor of Botany, George Washington University. 1930: B.A., California; 1932: M.A., California; 1946: Ph.D., Arizona; 1949–1953: Instructor in Botany, Weed Specialist, Assistant and Associate Professor of Botany, and Curator of the Herbarium, University of Arizona. Specialties: compositae of western U.S. and Mexico, especially the genera *Hymenoxys* and *Pectis;* flora of Arizona and New Mexico: weeds of the U.S., particularly Arizona. Fieldwork:

western U.S. Books: *Arizona Weeds* (1958); *Handbook for Forest Service Plant Collections* (1961). Articles: "*Hymenoxys* of Colorado," *Manual of the Plants of Colorado* (1958); "Two Species of *Hymenoxys* (Compositae) New for Arizona," *Leafl. Western Bot.* (1960); "The South American Species of *Hymenoxys* (Compositae)," *Leafl. Western Bot.* (1962).

HAROLD ROBINSON, Associate Curator, Division of Cryptogams. 1955: B.S., Ohio; 1957; M.S., Tennessee; 1960: Ph.D., Duke; 1960–1962: Assistant Professor, Wofford College. Specialty: taxonomy of Bryophyta, with emphasis on exotic forms and neotropical species, taxonomy and anatomy of compositae. Fieldwork: Mexico, Dominica. Articles: "A small Collection of Bryophytes from Upper Assam, India," *Jour. Hattori Bot. Lab.* (1964); "New Taxa and New Records of Bryophytes from Mexico and Central America," *Bryologist* (1964); "Notes on Leucobryaceae in Central America," *Bryologist* (1965); "A Small Collection of Bryophytes from Kashmir," *Bryologist* (1965); "Venezuelan Bryophytes Collected by Julian A. Steyermark," *Acta Bot. Venezuelica* (1965); with R. M. King, "Multiple Pollen Forms in two Species of the Genus *Stevia* (Compositeae)," *SIDA* (1967); with R. M. King, "Generic Limitations in the *Hofmeisteria* complex (Compositeae–Evpatorieae),'" *Phytologia* (1966); "Preliminary Study on the Bryophytes of Colombia," *Bryologist* (1967); with R. M. King, "Studies in the Compositeae–Eupatorieae VIII. Observations on the Microstructure of *Stevia,*" *SIDA* (1968).

VELVA E. RUDD, Curator, Division of Phanerogams. 1931: B.S., North Dakota State; 1932: M.S., North Dakota State; 1953: Ph.D., George Washington. Specialty: taxonomy and geography of Leguminosae, particulary of the neotropics. Fieldwork: Venezuela, Trinidad, Panama, Mexico. Articles: "The American Species of *Aeschynomene,*" *Cont. U.S. Nat. Herb.* (1955); "A Revision of the Genus *Nissolia,*" *Cont. U.S. Nat. Herb.* (1956); "A Revision of the Genus *Chaetocalyx,*" *Cont. U.S. Nat. Herb.* (1958); "The Genus *Aeschynomene* in Malaysia," *Reinwardtia* (1959); "The Genus *Dussia,*" *Cont. U.S. Nat. Herb.* (1963); "Nomenclatural Problems in the *Acacia cornigera* Complex," *Madroño* (1964); "The American Species of *Ormosia* (Leguminosae)," *Cont. U.S. Nat. Herb.* (1965); "A Resume of *Ateleia* and *Cyathostegia* (Leguminosae)," *Cont. U.S. Nat. Herb.* (1968). Speaks Spanish.

STANWYN G. SHETLER, Associate Curator, Division of Phanerogams; 1955: B.S., Cornell; 1958: M.S., Cornell; work toward Ph.D., Michigan. Specialties: taxonomy and ecology of *Campanula;* flora and vegetation of the Arctic, especially Alaska; application of statistical methods to the study of variability in natural populations; history of Russian botany. Fieldwork: throughout the U.S. and Canada. Books: with F. Montgomery, *Insectivorous Plants*, Sm. information leaflet (1965); *The Komarov Botanical Institute* (1968). Articles: "Notes on the Life History of *Campanula americana*, the Tall Bellflower," *Michigan Botanist* (1962); "An Annotated List of Vascular Plants from Cape Sabine, Alaska," *Rhodora* (1963); "A Checklist and Key to the Species of *Campanula* Native or Commonly Naturalized in North America," *Rhodora* (1963); "Priority and the Stabilization of Names," *Taxon* (1964); "Plants in the Arctic–Alpine Environment," *Annual Rpt. of the Sm. Inst.... 1963* (1964).

LYMAN B. SMITH, Senior Botanist; Professional Lecturer and Member of the Graduate Council (for preparation of Ph.D. candidates), George Washington University, 1925: B.A., Harvard; 1928: M.A., Harvard; 1930; Ph.D., Harvard; 1930–1947; Assistant to the

Assistant Curator, Gray Herbarium, Harvard University. Specialties: taxonomy of Bromeliaceae, Begoniaceae, Velloziaceae, and Xyridaceae; flora of Santa Catarina, Brazil. Fieldwork: Gaspé, Canada; Rio de Janiero and Sao Paulo, Brazil; Cuba; Argentina; Brazil. Articles: "The Bromeliaceae of Brazil," *Sm. Misc. Coll.* (1965); with R. J. Downs, "Resumo preliminar das Rubiaceas de Santa Catarina," *Sellowia* (1959); "Origins of the Flora of Southern Brazil," *Cont. U.S. Nat. Herb.* (1962); "A Synopsis of the American Velloziaceae," *Cont. U.S. Nat. Herb.* (1962); with R. J. Downs, "Solanaceas," *Flora Ilustrada Catarinense* (1966). Speaks Portuguese. Not in residence part of 1970–71.

THOMAS R. SODERSTROM, Associate Curator, Division of Grasses. 1957: B.S., Illinois; 1958: M.S., Yale; 1961: Ph.D., Yale. Specialty: taxonomy and comparative anatomy of New World grasses. Fieldwork: Arizona, Mexico, Guayana, Trinidad, Surinam, Costa Rica, Colombia, Brazil, Java, India. Articles: "The Isocitric Acid Content of Crassulacean Plants and a Few Succulent Species from Other Families," *Am. Journ Bot.* (1962); with H. F. Decker, "*Swallenia*, a New Name for the California Genus *Ectosperma* (Gramineae)," *Madroño* (1963); with H. F. Decker "*Reederochloa*, a New Genus of Dioecious Grasses from Mexico," *Brittonia* (1964); with H. F. Decker, "*Allolepis:* A New Segregate of *Distichlis* (Gramineae)," *Madrono* (1965); "Gramineae" in "The Botany of the Guayana Highland," *Mem. N.Y. Bot. Gard.* (1965); "Taxonomic Study of Subgenus *Podosemum* and Section *Epicampes* of *Muhlenbergia* (Gramineae)," *Cont. U.S. Nat. Herb.* (1967). Speaks Spanish, Portuguese.

EGBERT H. WALKER, Botanist Emeritus. 1922: B.A., Michigan; 1928: M.S., Wisconsin; 1940: Ph.D., Johns Hopkins; 1918–1922: Instructor, Lingnan University, Canton, China; 1922–1926: High school teacher in China; 1926–1928; graduate Assistant in University; 1928–1958; aid to associate curator, Smithsonian Institution. Specialties: taxonomy of plants of China, Japan, and the Ryukyu Islands; Myrcinaceae of eastern Asia; bibliography of Asiatic botany, taxonomy, botanical bibliography, Okinawan botany. Fieldwork: New Zealand, Okinawa and southern Ryukyu Islands, Thailand, Japan, Vietnam, Philippines; current research on flora of Okinawa. Books: *Important Trees of the Ryukyu Islands,* U.S. Civil Adm., Ryukyu Islands (1954); with E. D. Merrill, *A Bibliography of Eastern Asiatic Botany* (1938; *Supplement,* 1960); ed., with F. G. Meyer, *Flora of Japan* (in English), by Jisaburo Ohwi (1965). Articles: "A Revision of the Eastern Asiatic Myrisinaceae," *Philippine Journ. Sci.* (1940); "The Plants of China and Their Usefulness to Man," *Annual Rpt. of the Sm. Inst. . . . 1943* (1944); "Concerning the Myrsinaceae ('Ardisiaceae') of Japan," *Bot. Mag. Tokyo* (1954).

JOHN J. WURDACK, Curator, Division of Phanerogams. 1942: B.S., Pittsburgh; 1949: B.S. San. Eng., Illinois; 1952: Ph.D., Columbia; 1952–1959: Assistant and Associate Curator, New York Botanical Garden. Specialties: taxonomy of neotropical Melastomataceae, particularly of South America; flora of tropical South America. Fieldwork: Venezuela, Colombia, Brazil, Peru. Articles: "A Revision of the Genus *Brachyotum* (Tibouchineae–Melastomataceae)," *Mem. N.Y. Bot. Gard.* (1953); Part II in "The Botany of the Guayana Highland," *Mem. N.Y. Bot. Gard.* (1957); "Melastomataceae of Santa Catarina," *Sellowia* (1962); "Melastomataceae" in "The Botany of the Guayana Highland," Part IV, *Mem. N.Y. Bot. Gard.* (1964); "Certamen Melastomataceis XI," *Phytologia* (1967); "Certamen Melastomataceis XIII," *Phytologia* (1969).

DEPARTMENT OF ENTOMOLOGY

The Department of Entomology has research and curatorial responsibilities for the classes *Insecta, Chilopoda, Diplopoda, Arachnida, Symphyla,* and *Pauropoda;* this immense assemblage, constituting most of the phylum *Arthropoda,* comprises approximately 75 percent of the estimated known animal species of the world. Ideally the Department's research objective is to investigate and make known all aspects of the animals comprising these arthropod classes. This aim is pursued by making available to Smithsonian and allied staff members, as well as to other serious students, the specimens for study, the records, the information, and when possible the guidance upon which basic taxonomic and related investigations are dependent. The research program is necessarily oriented primarily toward those fundamental taxonomic studies that are required to elucidate the enormous and as yet relatively poorly known fauna comprising these classes. The morphological and supportively ancillary studies on which classical taxonomy is based are supplemented by field investigations of the life history, ecology, and behavior of selected groups of insects, arachnids, and myriapods.

Collections

The collections contain substantially more than 17 million specimens, a holding second in size only to that of the British Museum. Worldwide in scope, the collections, so pertinent to most groups, are second to none in coverage for the nearctic and neotropical regions. Outside of these major geographical areas the Department has comprehensive study collections from a number of others, most notably from the Philippines, Micronesia, and Egypt. Typical material is represented by not less than 70,000 holotypes (and other primary types) and by scores of thousands of paratypes (and other secondary types).

Supplementary Staff

The Department's efforts are complemented and assisted by twenty-six insect taxonomists of the U.S. Department of Agriculture, by four specialists of the Southeast Asia Mosquito Project of the U.S. Army, and by the *Siphonaptera* research group of the University of Maryland School of Medicine. Inasmuch as nearly all of the persons representing these non-Smithsonian research groups occupy office and laboratory space in the facility housing the Department, the staff thereby enjoys the valuable, uncommon advantages of close and immediate cooperation and consultation, channeling the expertise of a host of different disciplines and areas of research authority into a common pool of scholarly resources and productive potential.

The Department maintains its own library, consisting primarily of entomological periodicals, separate books, reference compendia, and other pertinent publications.

Fieldwork

Specialists on the combined staffs have undertaken field trips in many parts of the United States, Mexico, Central and South America, and, to a lesser extent, such areas as Europe, Africa, Australia, and miscellaneous islands widely scattered throughout the Pacific. Staff members have also participated in expeditions to various of the Caribbean islands, most notably to the Antilles where the fauna of Dominica is being exhaustively investigated, and recently to the Antarctic.

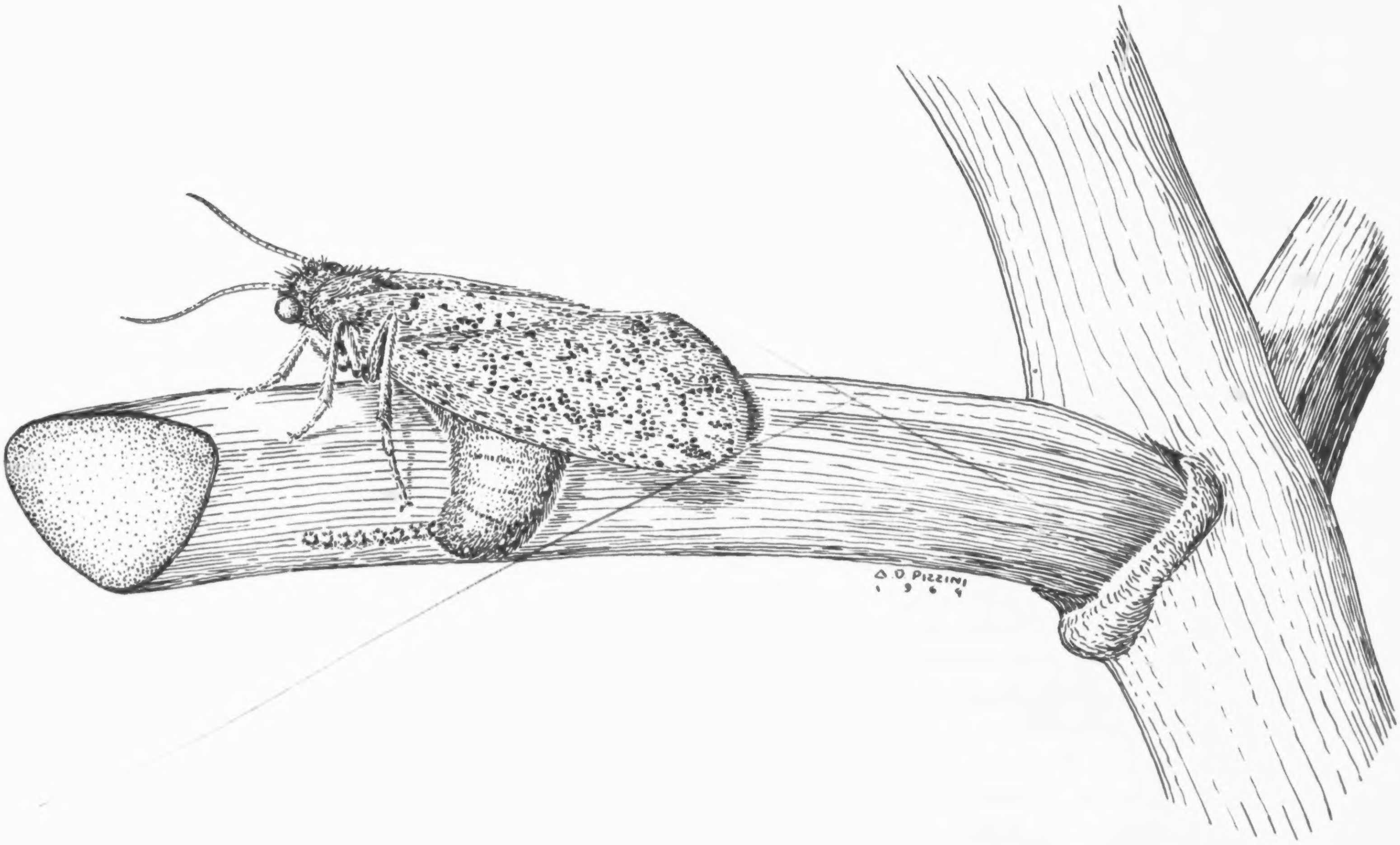
Subject to prior arrangement with the staff specialist concerned, well-qualified post-and predoctoral research associates who can obtain NAS or NSF funds for extended periods of study here, are welcomed. Space and facilities permitting, and following prior understanding with the pertinent specialist, the staff welcomes the research visits of entomological colleagues from governmental and private sister institutions, from colleges and universities, and in general from the expert scholarly community at large.

Administratively the Department is organized into five Divisions:

Coleoptera

The primary functions of the Division of Coleoptera are to conduct research on the systematics, behavior, and ecology of adult and immature beetles, and to house, maintain, and enlarge the collection on a worldwide scope. Present emphasis in research is placed on systematic and biological studies of numerous families of beetles, chiefly representing the nearctic and neotropical regions.

The *Coleoptera* collection is the largest in the Western Hemisphere; it is estimated to contain between five and six million specimens and is especially rich in North American species. Present emphasis is placed on obtaining material from areas south of the United States and from the Eastern Hemisphere. The collection of adult *Coleoptera* is enriched by the T. L. Casey Collection, which contains numerous types of primary importance in studies of American *Coleoptera.* Other important collections are as follows: G. H. Dieke *(Coccinellidae,* 12,500 specimens); R. Korschefsky *(Coccinellidae,* 10,500); F. Monros *(Chrysomelidae,* 58,000); J. D. Sherman (aquatic *Coleoptera,* 21,000); F. F. Tippmann *(Cerambycidae,* 98,000); O. L. Cartwright *(Scarabaeidae,* 40,000). Through accelerated field activities during the last few years, staff members have added 195,000 specimens. The collection of beetle larvae, acquired through the efforts of A. G. Boving, is one of the largest in existence and contains specimens drawn from all parts of the world.



Female of *Parategeticula pollenifera* in the act of ovipositing on lateral flower stalk of *Yucca schottii*, used in D. R. Davis' monographic study of the Yucca pollinating subfamily Prodoxinae.

Hemiptera and Hymenoptera

The major taxonomic effort in the Division of Hemiptera and Hymenoptera is to perform "beta" taxonomy, the synthesis of revisions and monographs to open the field to more scholars. Biological and ecological studies have been undertaken in some of the taxonomically better known groups, such as the higher *Hymenoptera.* The principal objective is to build and maintain a reference collection of the world's modern and fossil members of the insect orders *Hemiptera* (including *Heteroptera* and *Hompotera), Hymenoptera,* and *Thysanoptera.* The emphasis on collection growth and research effort is principally for the Americas, with the Old World problems being dictated chiefly by the availability of specimens and by demands. Of particular interest are the H. G. Barber and C. J. Drake Collections of *Heteroptera,* the J. Douglas Hood Collection of *Thysanoptera,* and the W. H. Ashmead and C. F. Baker Collections of *Hymenoptera.*

Lepidoptera and Diptera

The collection of the Division of Lepidoptera and Diptera contains the most complete representation of both larval and adult *Lepidoptera* in the Western Hemisphere and is second only to that of the British Museum in its total coverage. The collection is particularly rich in nearctic and neotropical species and also demonstrates a good representation of palearctic material for most families. The total number of *Lepidoptera* in the national collection is not known exactly, but it is estimated to be between two and three million specimens, including the W. Barnes (450,000) and P. Dognin (50,000) collections.

Because of thy extremely impoverished state of knowledge concerning most groups of *Lepidoptera* of this hemisphere and particularly of the neotropical region, present research efforts are being directed toward comprehensive monographs of the major families. Studies involving the *Microlepidoptera* currently are receiving greatest emphasis because this large group is both the poorest known and by far the least collected by entomologists.

The collections of *Diptera* rank among the most extensive in the world. Several large acquisitions, such as the collections of S. W. Bromley (35,000), A. L. Melander (250,000), and A. E. Pritchard (27,000), have greatly expanded Smithsonian coverage of this important order. Among the families that are particularly well represented are the *Asilidae, Tachinidae, Cecidomyiidae* and *Culicidae.*

Major research emphasis currently is being directed toward monographic studies of the taxonomy and ecology of the mosquitoes of Southeast Asia. This program is administered by the Smithsonian under a grant from the Department of the Army.

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Myriapoda and Arachnida

The Division of Myriapoda and Arachnida has responsibility for the classes *Chilopoda, Diplopoda, Arachnida, Symphyla* and *Pauropoda.* Pertinent to the arachnid orders, the Division's largest and most important holdings are represented in the *Acarina* and *Araneida.* Holdings in the lesser arachnid orders, although as yet comparatively small, are growing steadily nonetheless; each such order boasts some typical material, some specimens of which are especially valuable chiefly owing to their species' extreme rarity in collections.

The holdings in spiders, chiefly of the New World, are relatively sizable, but, owing to the vastness and complexity of the group, and because there has never been an araneologist per se on the staff, the bulk of the nontypical spiders remains unclassified even to family. The collection of typical spiders is substantial in size, and much of it is of considerable consequence. Included in it are many of the typical specimens of such notable workers as N. Banks, R. V. Chamberlin, H. Exline, I. Fox, E. V. Keyserling, G. Marx, A. Petrunkevitch, and E. Simon, some of whom were pioneer students of the American fauna.

Unquestionably the most active, largest, and most important arachnid collection is that of the order Acarina. In terms of its holdings of mites parasitizing man, animals, and plants, it is the finest in existence. Excluding oribatid mites, it is the foremost collection in the Western Hemisphere; and in global purview it ranks second only to that of the British Museum. Its typical holdings are immense in number and of the most fundamental importance to acarological research throughout the world. Some of the more important of its typical components are the following: nearly the complete collection of E. W. Baker; numerous important specimens of N. Banks; the complete collection of H. E. Ewing; most of the collection of A. P. Jacot; typical specimens representing all of the new species described by A. Fain from the Congo. Finally, acarine holdings are representative virtually of every quarter of the globe.

In intrinsic value for research and in size the myriapod holdings are second only to the *Acarina.* Our *Myriapoda* are chiefly, though by no means wholly, New World in derivation and are growing and diversifying rapidly. The collection contains nearly all of the types of C. H. Bollman, O. F. Cook, R. E. Crabill, R. L. Hoffman, H. F. Loomis, and J. McNeill. Consequently this is probably the second most important type collection in the New World. Although the Americas are best represented in typical and nontypical material, specimens from many other quarters of the world are present as well. Through current and expanding programs of collecting, exchanges, and other sorts of acquisitions the holdings are growing rapidly and are achieving an increasing measure of systematic balance and ubiquity.

Neuropteroids

The research objectives of the Division of Neuropteroids are taxonomic and biological investigations of the *Trichoptera, Plecoptera, Neuroptera, Isoptera, Mecoptera, Mallophaga, Anoplura, Siphonaptera, Odonata, Orthoptera, Embioptera, Zoraptera,* and *Psocoptera.* Emphasis is placed on the New World fauna, especially in the *Trichoptera, Isoptera,* and *Orthoptera.* The Carriker Collection of *Mallophaga,* which is especially rich in types (650) of neotropical species, and the Jellison Collection of ectoparasites are the outstanding acquisitions in the Division. Although there are few outstanding collections, important holdings have built up over the years in many orders, such as the collection of *Isoptera,* which is the second largest in the world, containing 1,150 species of the world fauna of 2,000 species. The collections of ectoparasites are extensive and worldwide in scope, while those in the other groups are strongest in New World species.

Research Staff

OSCAR L. CARTWRIGHT, Curator, Division of Coleoptera. 1923: B.S., Allegheny; 1925: M.S., Ohio State; 1925–1945, 1947: Agricultural Research Entomologist, South Carolina Agricultural Experiment Station. Specialty: systematic and faunal studies in Scarabraeidae and Cicindelidae; current research on systematic revisions of scarab beetles, world wide revision of the genus *Ataenius.* Fieldwork: South Carolina, Texas, Arizona, Florida, Mississippi, Costa Rica, El Salvador, Bahamas. Articles: "The American Species of *Pleurophorus* the Genus *Bradycinetulus* and Closely Related Genera in the United States," *Proc. USNM* (1953); "Scarab Beetles of the Genus *Psammodius* in the Western Hemisphere," *Proc. USNM* (1955); "Scarab Beetles of the Genus *Bothynus* in the United States," *Proc. USNM* (1959); with H. F. Howden, "Scarab Beetles of the Genus *Onthophagus* Latreille North of Mexico," *Proc. USNM* (1963); "Lectotype Designations and New Synonomy in the Genus *Ataenius* (Coleoptera: Scarabaeidae)," *Coleopterists' Bul.* (1964).

J. F. GATES CLARK, Senior Entomologist. 1926: Ph.C., Washington State; 1930: B.S., Washington State; 1931: M.S., Washington State; 1953: Ph.D., London; 1931–1935: Instructor, Washington State University; 1936–1954: Lepidopterist, U.S. Department of Agriculture; 1954–1963: Curator, Division of Insects, Smithsonian; 1963–1965: Chairman, Department of Entomology, Smithsonian. Specialties: systematics, ecology, and zoogeography of New World and Oceanic *Microlepidoptera,* especially Oecophoridae and Phaloniidae; faunal studies of Pacific Islands, Pacific Northwest North America, and the neotropical region. Current research on systematics, ecology, and zoogeography of *Microlepidoptera.* Fieldwork: Caroline Islands (Truk, Guam, Ponape, Kusaie), Colombia, Peru, Bolivia, Argentina, Chile, Northwest North America, Arkansas, Yucatan, England, Scotland, Sweden, St. John, St. Thomas, Tortola, Jost Van Dyke, St. Martin, Guano, Peter, Anguilla, Anegada, Redonda, Barbuda, Antigua, Guadeloupe, Dominica, St. Kitts and Nevis Islands, Society Islands (Tahiti, Huahine), Austral Islands (Raivavae, Rapa), Fiji, Sarawak, Australia, Ceylon. Books: *Catalogue of the Type Specimens of Microlepidoptera in the British Museum (Natural History) Described by Edward Meyrick* (1955, 1958, 1963, 1965); *A Golden Book of Butterflies* (1963). Articles: "The Preparation of the Slides of the Genitalia of *Lepidoptera,*" *Bul. Brooklyn Ent. Soc.* (1941); "Revisions of North American Moths of the Family Oecphoridae, with Descriptions of New Genera and Species," *Proc. USNM* (1941); "Neotropical Moths of the Genus *Orthocomotis* Dognin *(Lepidoptera: Tortricidae),*" *Trans. R. Ent. Soc. London* (1955); "*Microlepidoptera* of Juan Fernandez Islands, "*Proc. USNM* (1955).

RALPH E. CRABILL, Jr., Curator, Division of Myriapoda and Arachnida. 1949: B.A., Cornell: 1952: Ph.D., Cornell; 1949–1954: Assistant Professor, Ithaca College; 1954–1956: Assistant Professor, St. Louis University. Specialty: Systematics, evolution, zoogeography of *Chilopoda.* Fieldwork: United States, Europe.

DONALD R. DAVIS, Curator, Division of Lepidoptera and Diptera. 1956: B.A., Kansas; 1962: Ph.D., Cornell, Specialties: classification, phylogeny, and life history of the microlepidopterous superfamilies *Incurvarioidea* and *Tineoidea;* biology of leafmining Lepidoptera, especially the Gracillariidae. Currently making systematic studies of *Microlepidoptera.* Fieldwork: southwestern United States, Finger Lakes region of New York, Mexico, Dominica, Philippines. Books: *Bagworm Moths of the Western Hemisphere (Lepidoptera: Psychidae)* (1964); *A Revision of the Moths of the Subfamily Prodoxinae (Lepidoptera: Incurvariidae)* (1967); *A Revision of the American Moths of the Family Carponsinidae (Lepidoptera: Carposinoidea)* (1969). Articles: "A Review of the Genus *Acanthopteroctetes* with a description of a New Species (Lepidoptera: Eriocraniidae)," *Journal Lep. Soc.* (1969).

W. DONALD DUCKWORTH, Curator, Division of Lepidoptera and Diptera. 1957: B.S., Middle Tennessee State; 1960: M.S., North Carolina State; 1962: Ph.D., North Carolina State; 1957–1962: Research Assistant, North Carolina State University. Specialty: classification, phylogeny, and zoogeography of the microlepidopterous families *Stenomidae* and *Yponomeutidae;* currently doing revisionary study of the microlepidopterous family *Stenomidae* in the Western Hemisphere. Fieldwork: southeastern United States, Mexico, Panama, El Salvador, Costa Rica, Colombia, Venezuela, Trinidad, Puerto Rico, Jamaica, Brazil, Guayana. Articles: "A New Brazilian Moth of the Genus *Gonioterma* with Notes on Related Species," *Proc. USNM* (1964); "North American *Stenomidae* (Lepidoptera: Gelechioidea)," *Proc. USNM* (1964); "Neotropical *Microlepidoptera IV.* A New Genus of *Stenomidae* with Descriptions of New Species *(Lepidoptera: Gelechioidea),*" *Proc. USNM* (1964); "North American Moths of the Genus *Swammerdamia (Lepidoptera: Yponomeutidae),*" *Proc. USNM* (1965); "Neotropical *Microlepidoptera VIII.* A Review of the Genus *Falculina* with Description of New Species *(Lepidoptera: Sternomidae),*" *Proc. USNM* (1966); "Neotropical *Microlepidoptera XII* Further Studies on the Genus *Lethata (Lepidoptera: Stenomidae),*" *Proc. USNM* (1967); Neotropical *Microlepidoptera XIII.* A Review of the Genus *Loxotoma (Lepidoptera; Stenomidae),*" *Proc. USNM* (1967).

WILLIAM D. FIELD, Associate Curator, Division of Lepidoptera and Diptera. 1936: B.A., Kansas; 1938: M.A., Kansas; 1939, 1940: graduate work, Kansas; 1940–1947:

Entomologist, Division of Insect Identification, Bureau of Entomology and Plant Quarantine, U.S. Department of Agriculture, Specialties: classification of the butterflies of the New World, especially the *Lycaenidae, Pieridae,* and *Nymphalidae.* Fieldwork: Southwestern United States, Colorado, Okinawa, Tennessee, Georgia, South Carolina, Maine, West Virginia, New England. Book: *A Manual of the Butterflies and Skippers of Kansas* (1940). Articles: "A Redefinition of the Genera *Tatochila, Phulia, Piercolias* and *Baltia,* with the Description of Some New and Closely Related Genera and Subgenera," *Proc. USNM* (1958); "Moths of the Genus *Rhabdatomis* Dyer," *Proc. USNM* (1964); with Jose Herrera, "A Revision of the Butterfly Genera *Theochila* and *Tatochila," Proc. USNM (1959); "Preliminary Revision of Butterflies of the Genus* Calycopis *Scudder, Proc. USNM* (1967); "Butterflies of the New Genus *Calystryma,"* Proc. USNM (1967).

OLIVER S. FLINT, JR., Curator, Division of Neuropteroids. 1953: B.S., Massachusetts; 1955: M.S., Massachusetts; 1960: Ph.D., Cornell. Specialties: taxonomy and biology of the *Trichoptera* of North, Central, and South America and the West Indies; taxonomy and biology of the *Megaloidea* of the New World. Fieldwork: West Indies, Central America, Chile, Antarctica. Articles: "Taxonomy and Biology of Nearctic Limnephilid Larvae (Trichoptera), with Special Reference to Species in Eastern United States," *Entomologica Americana* (1960); "Studies of Neotropical Caddis Flies, I. *Rhyacophilidae* and *Glossosomatidae," Proc. USNM* (1963); "The Caddis Flies *(Trichoptera)* of Puerto Rico," *Agr. Exp. Sta., Univ. P.R. Tech. Paper* (1964); "The Genus *Neohermes (Megaloptera; Corydalidae)," Psyche* (1965); "Studies of Neotropical Caddis Flies, III. Trichoptera Collected by Prof. Dr. J. Illies in the Chilean Subregion," *Beitr. z. Neotropical Fauna* (1967); "Studies of Neotropical Caddis Flies. V. Types of the Species Described by Banks and Hagen," *Proc. USNM* (1967); "The Caddis Flies of Jamaica," *Bull. Inst. Jamaica* (1968); "The *Trichoetera* of the Lesser Antilles," *Proc. USNM* (1968).

RICHARD C. FROESCHNER, Curator, Division of Hemiptera and Hymenoptera. 1941: B.S., Missouri; 1951: M.S., Iowa State College; 1954; Ph.D., Iowa State College; 1954–1961: Associate Professor, Montana State College; 1961–1962; Entomologist, U.S. Department of Agriculture; 1962–1963: Associate Professor, Montana State University. Specialty: taxonomic revisions, chiefly in the *Hemiptera–Heteroptera;* current research on *Hemiptera–Heteroptera,* with special emphasis on *Cydnidae, Tingidae, and Pentatomidae.* Fieldwork: United States. Current research on manual to the lace bug genera *(Hemipterai, Tingidae)* of the world. Articles: "Cydnidae of the Western Hemisphere," *Proc. USNM* (1960); "Revision of the South African Genus *Dearcla* Signoret with Descriptions of Three New Species *(Hemiptera: Cydnidae)," Ent. News* (1961); "Contributions to a Synopsis of the Hemiptera of Missouri. Parts I–V," *Amer. Midl. Nat.* (1941, 1942, 1944, 1949, 1962); "The Genus *Ceraleptus* Costa in the Western Hemisphere," *Journ, Kansas Ent. Soc. (1963); "Review of the Genus Atractotomus* Fieber in North America with Notes, Key and Description of One New Species," *Bul. Brooklyn Ent. Soc.* (1963); *"Larinocerus balius,* a New Genus and New Species of Plant Bug from the United States *(Hemiptera: Miridae)," Ent. News* (1965); "Synonymy of a West Indian Spittlebug, Deleting the Genus Clovia from the Americas," *Proc. Ent. Soc. Washington* (1966); "Two New Species of the Australian Genus *Blaena* with Notes on Previously Described Species *(Hemiptera: Cydnidae)," Journ. Kansas Ent. Soc.* (1966); "Lacebugs on the Galapagos Archipelago *(Hemiptera: Tingidae)," Proc. Ent. Soc. Washington* (1967); *"Telamona Archbold;* a New Treehopper from Florida *(Hemiptera: Membracidae," Proc. Ent. Soc. Washington* (1968); "Burrower Bugs from the Galapagos Islands Collected by the 1964 Expedition of the Galapagos Scientific Project *(Hemiptera: Cydnidae)*," *Proc. Ent. Soc. Washington* (1968); "Notes on the Systematics and Morphology of the Lacebug Subfamily Cantacaderinae *(Hemiptera: Tingidae)*," *Proc. Ent. Soc. Washington* (1968); "Lacebugs Collected During the Bredin-Archbold-Smithsonian Biological Survey of Dominica, B.W.I. *(Hemiptera: Tingidae)*," *Great Basin Naturalist* (1968).

KARL V. KROMBEIN, Chairman, and Curator, Division of Hemiptera and Hymenoptera. 1934: B.S., Cornell; 1935: M.A., Cornell; 1960: Ph.D., Cornell; 1951–1965: Leader of Taxonomic Investigations of *Hymenoptera*, Entomology Research Division, U.S. Department of Agriculture. Specialty: taxonomy and biology of solitary wasps. Fieldwork: New Guinea, Philippines, Okinawa, Egypt, Kenya, South Africa, Maryland, North Carolina, Florida, Arizona. Special technique: use of traps for twig nesting wasps and bees. Books: with C. F. W. Muesebeck et al., *Catalog of Hymenoptera North of Mexico* (1951) and supplements thereto (1958; 1967), U.S. Dept. Agr. Memoir No. 2; *Trap-Nesting Wasps and Bees: Life Histories, Nests, and Associates*, Smithsonian Press (1967). Articles: "A Generic Review of the Amiseginae, a Group of Phasmatid Egg Parasites, and Notes on the Adelphinae," *Trans. Amer. Ent. Soc.* (1957); "Natural History of Plummers Island, Maryland. XVI. Biological Notes on *Chaetodactylus krombeini* Baker, a Parasitic Mite of the Megachild Bee, *Osmia (Osmia) lignaria* Say," *Proc. Biol. Soc. Washington* (1962); "The Scoliidae of New Guinea, Bismarck Archipelago, and Solomon Islands," *Nova Guinea, Zool.* (1963); "Natural History of Plummers Islands, Maryland. XVIII. The Hibiscus Wasp. an Abundant Rarity, and Its Associates," *Proc. Biol. Soc. Washington* (1964).

PAUL J. SPANGLER, Curator, Division of Coleoptera. 1949: B.A., Lebanon Valley College; 1951: M.S., Ohio; 1951–1953: University of Kansas; 1960: Ph.D., Missouri; 1957–1958: Fishery Research Biologist, U.S. Fish and Wildlife Service, Juneau, Alaska; 1958–1962: Taxonomist, U.S. Department of Agriculture. Specialty: systematics, biology, and zoogeography of aquatic *Coleoptera*, including all families of water beetles; currently doing systematic revisions of aquatic beetles *(Haliplidae, Dytiscidae, Gyrinidae, Hydrophilidae, Elmidae, Psephenidae, Dryopidae, Noteridae, Limnichidae)* and description of their immature stages and life history. Fieldwork: Alaska, Canada, U.S., Dominica, Puerto Rico, St. Thomas, St. John, Mexico, Guatemala, El Salvador, Honduras, St. Croix, Nicaragua, Costa Rica, South America. Articles: "Description of the Larva of *Hydrovatus cuspidatus pustulatus* Melsheimer (Coleoptera: Dytiscidae)," *Journ. Kansas Ent. Soc.* (1962); "A New Species of the Genus *Oosternum* and a Key to the U.S. Species (Coleoptera: Hydrophilidae)," *Proc. Biol. Soc. Wasshing.* (1962); "Description of the Larva of *Macrovatellus mexicanus* Sharp (Coleoptera: Dytiscidae)," *Coleopterists' Bul.* (1963); "A New Species of *Derovatellus* from Guatemala and a Description of Its Larva *(Coleoptera: Dytiscidae)*," *Coleopterists' Bul.* (1966); "A Description of the Larva of *Derallus rudis* Sharp *(Coleoptera: Hydrophilidae)*," *Coleopterists' Bull.* (1966); "Results of Catherwood Foundation Peruvian–Amazon Expedition, Insects, Part XIII, The Aquatic *Coleoptera (Dytiscidae; Noteridae; Gyrinidae; Hydrophilidae; Dascillidae; Helodidae; Psephenidae; Elmidae)*," Acad. Nat. Sci. Philadelphia (1966); "A New Brazilian *Berosus* and Description of the Female of *B. spectatus* D'Orchymont *(Coleoptera: Hydrophilidae)*, *Proc. Ent. Soc. Washington* (1967); "A New Species of *Laccobius* from the Greater Antilles," *Proc. Biol. Soc. Washington* (1968).

GERALD I. STAGE, Assistant Curator, Division of Hemiptera and Hymenoptera. 1957: B.S., California, Berkeley; 1966: Ph.D., California, Berkeley; 1959–1963: Museum Curatorial Assistant, California Academy of Sciences; 1964–1967: Assistant Research Entomologist, University of California. Specialties: systematics and biology of bees, systematics of chalcid-flies. Current research on biosystematics of Melittidae, particularly *Hesperapis* and related genera; relationships of bees associated with certain species of *Eucnide* and *Mentzelia* (Loasaceae); ecology of the pollinators of *Lysimachia* (Primulaceae). Special techniques: procedures used in studying solitary bee biology and ecology. Fieldwork: Maryland, Virginia, Massachusetts; throughout Western U.S., Baja California, Venezuela. Articles: "First North American Host Record of the Adventive Wasp, *Chrysis fuscipennis Brulle* (Hymenoptera: Chrysidae)," *Pan-Pac. Ent.* (1960); with J. A. Powell, "Prey Selection by Robberflies of the Genus *Stenopogon*, with Particular Observations on *S. engelharti* Bromley (Diptera: Asílidae)," *Wasmann Journ. Biol.* (1962); with C. N. Slobodchikoff, "New Distribution and Host Records of *Bareogonalis canadensis* (Harrington) (Hymenoptera: Trigonalidae and Vespidae)," *Pan-Pac. Ent.* (1962); with H. V. Daly, T. Brown, "Natural Enemies of Bees in the Genus *Ceratina* (Hymenoptera: Apoidea)," *Ann. Ent. Soc. Am.* (1967); with Robbin W. Thorp, "Ecology of *Andrena Placida* with Descriptions of the Larva and Pupa," *Ann. Ent. Soc. Am.* (1968).

Department of Entomology, Research Associates:

EDWARD W. BAKER, Investigations Leader of Acarina, Agriculture Research Service, Department of Entomology, U.S. Department of Agriculture. Specialist in the study of mites.

DORIS H. BLAKE, Honorary Research Associate (Coleoptera), Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution; Assistant Entomologist, U.S. Department of Agriculture. Taxonomic studies of Chrysomelid beetles.

BARNARD D. BURKS, Investigations Leader of Hymenoptera, U.S. Department of Agriculture, U.S. National Museum. Parasitic Hymenoptera; biological control.

K. C. EMERSON, Honorary Research Associate, Department of Entomology, National Museum of Natural History, Smithsonian Institution; Special Assistant for Research, Secretary of the Army. Systematic studies, Anoplura and Mallophaga (insects).

ASHLEY B. GURNEY, Investigations Leader of Orthoptera, Systematic Entomology Laboratory, U.S. Department of Agriculture. Systematics and allied aspects of Orthoptera (broad sense), especially New World cockroaches and North American grasshoppers–also Zoraptera.

JOHN M. KINGSOLVER, Investigations Leader of Coleoptera, Research Entomologist U.S. Department of Agriculture. Taxonomy of Coleopterous family Bruchidae.

C. F. W. MUESEBECK, Honorary Research Associate, Department of Entomology, National Museum of Natural History, Smithsonian Institution; Principal Entomologist, Division of Insect Identification, U.S. Department of Agriculture. Parasitic Hymenoptera.

LOUISE M. RUSSELL, Investigations Leader of Hemiptera and Thysanoptera, Systematics Entomology Laboratory, Entomology Research Division, Agriculture Research Service, U.S. Department of Agriculture. Hemiptera and Sternorhyncha.

CURTIS W. SABROSKY, Director, Systematic Entomology Laboratory, Department of Agriculture, Entomology Research Division. Pachinipae, Chloropidae and miscellaneous Diptera.

THOMAS E. SNYDER, Honorary Research Associate (Isoptera), Department of Entomology, National Museum of Natural History; Senior Entomologist, Forest Insect Investigations, Bureau of Entomology and Plant Quarantine, U.S. Department of Agriculture. Specialist on termite studies.

ALAN STONE, Investigations Leader of Diptera, Research Entomologist, Systematics Entomology Laboratory, U.S. Department of Agriculture. Taxonomy of Diptera: Culicidae, Tabanidae, Simuliidae.

EDWARD L. TODD, Investigations Leader of Lepidoptera, Department of Entomology, Agriculture Research Service, U.S. Department of Agriculture. Taxonomy of Noctuidae (Lepidoptera) and Gelastocoridae (Hemiptera)

ROBERT TRAUB, Honorary Research Associate (Siphonaptera), Department of Entomology, National Museum of Natural History, Smithsonian Institution, Vectors and Reservoirs of Infection (ecology; systematics).

DEPARTMENT OF INVERTEBRATE ZOOLOGY

Research

The Department of Invertebrate Zoology carries on a broad, interdisciplinary research program with primary emphasis on studies of the classification, diversity, relationships, distribution and evolution of invertebrate animals other than insects. Traditionally, departmental research programs have dealt with aquatic invertebrates, from both marine and freshwater habitats. Most of the individual research projects are collection-oriented, drawing upon the information associated with the twelve million specimens under the care of the department. The diversity of the research programs now under way is reflected in the work of the staff in comparative morphology and anatomy, embryology and larval development, biology of plankton, structure of benthic communities, ecology of warm temperate communities, biology of the deep sea, and the evolution of parasites in relation to that of their hosts.

The facilities available for research on invertebrate animals at the Smithsonian are outstanding. The collections, which reflect interests of past as well as present staff members, are well documented and well curated; in some groups, particularly Crustacea and Mollusks, they are among the finest study collections in the world. Scientific literature is available in divisional libraries, the main library of the Institution, and the Library of Congress. In addition to diverse laboratory facilities, including histology laboratory, darkroom, aquarium rooms, and visitors' laboratories convenient to the collections, modern optical equipment is available. Field studies are encouraged and, during the past year, staff members have carried out investigations in Australia, Hawaii, Europe, Egypt, Pakistan, the West Indies, and the eastern United States.

Cooperative Work

Research programs carried on by the Department are complemented by educational agreements with the Department of Zoology, George Washington University, the Institute of Marine Science, University of Miami, and the Department of Biology, Wake Forest University. Under these agreements graduate students may come to the National Museum of Natural History for training and to study material in the national collections. In addition, cooperative research programs are being carried out with the Bernice P. Bishop Museum, Hawaii, the Marine Biological Laboratory, Woods Hole, and the U.S. Fish and Wildlife Service, as well as with other individuals and organizational units within the Museum of Natural History.

Division of Crustacea

Emphasis on the study of Crustacea, a tradition handed down by J. E. Benedict, Mary J. Rathbun, C. R. Shoemaker, and W. L. Schmitt, continues at the Smithsonian. Staff members of the Division of Crustacea, taking advantage of the fine collections, are engaged in research programs on the systematics and biology of parasitic and free-living copepods, myodocopid ostracods, gammaridean and hyperiidean amphipods, cymothoid isopods, decapods, including crayfishes and their ostracod associates, and stomatopods, A research associate investigating the systematics of American commercial shrimp is in residence this year.

Division of Echinoderms

Representatives of eleven phyla, including sponges, coelenterates, echinoderms, lophophorate coelomates, hemichordates, and urochordates, are the responsibility of this division, which contains the nucleus of a planned new division, Lower Invertebrates. Present research interests are focused on the systematics and ecology of tropical and subtropical marine littoral sponges and deep sea corals, as well as studies on the systematics, zoogeography, and evolution of echinoids and holothuroids.

Recent fieldwork in the Southern Ocean, the Indo-Pacific, and the Caribbean Sea has considerably increased the collections of sponges, corals, and echinoderms. Among the important older collections available for study are the Gist Gee collection of fresh water sponges, the Osborn collection of Bryozoa, the T. W. Vaughan collection of corals, and the C. C. Nutting collection of hydroids.

Histological techniques are used routinely. The usefulness of biochemical methods in systematics is currently under investigation. Modern measuring techniques have been developed for *in situ* studies on physiological ecology of selected sessile organisms.

Division of Mollusks

Primary emphasis is placed on studies of classical systematics of mollusks. Resources include one of the largest and best curated collections of its kind in the world, as well as extensive library facilities, of which the William Healey Dall Library of Malacology forms the nucleus. Areas of special interest include the J. G. Jeffreys collection of European mollusks, the Isaac Lea freshwater collection, and collections from many of the Pacific islands accumulated in over a century of exploration. Both coasts of North and South America, as well as Alaska, are also represented by extensive collections.

Research presently under way includes investigation into systematics and zoogeography of Indo-Pacific marine mollusks, of the fresh and brackish water mollusks of the world, and of the Cephalopoda.

Division of Worms

Although the Division is responsible for fourteen phyla, which comprise the vermiform invertebrates, primary research interest centers around the polychaetous annelids, the free-living marine nematodes, and the Sipuncula. A research associate is concerned with studies of the triclad platyhelminthes and two visiting research associates are working on leeches and on branchobdellid annelids. Two graduate students pursue research on the polychaetes. Not all of the research is in classical taxonomy, for there is nearly equal emphasis on studies of life histories, comparative morphology and post-zygote development, and on quantitative aspects of population ecology.

It has only been in the past decade that active workers on the worms have been on the staff of the Museum, and this is reflected in the size of the collections. Utilizing as a basis the large collections of the U.S. Fish Commission and of the *Albatross,* as well as the polychaete collections of H. E. Webster and of Edith and Cyril Berkeley, the oligochaete collections of Frank Smith and A. Weir Bell, and the leech collection of J. Percy Moore, the holdings of the Division are increasing in size and usefulness, as well as in geographic scope. Recent concentration of effort has been on the polychaetes and the nematodes, and numerous unworked collections, particularly from the Gulf of Mexico–Caribbean region, are available for study by qualified workers.

Research Staff

J. L. BARNARD, Curator, Division of Crustacea. 1949: B.A., Southern California; 1950: M.S., Southern California; 1953: Ph.D., Southern California; 1953–1959: Marine Biologist, Allan Hancock Foundation; 1960–1964: Marine Biologist, Beaudette Foundation. Specialties: Gammaridean Amphipoda of warm-temperature littoral and world bathyal-abyssal; census of benthic mud communities. Fieldwork: all countries from north Alaska to Ecuador on the Pacific shores; Hawaii, New Zealand, Australia, Africa. Articles: "Deep-Sea Amphipoda (Crustacea) Collected by the R/V Vema in the Eastern Pacific Ocean and the Caribbean and Mediterranean Seas," *Bul. Am. Mus. Nat. Hist.* (1964); "Marine Amphipoda of Atolls in Micronesia," *Proc. USNM* (1965); "Bathyal and Abyssal Gammaridean Amphipoda of Cedros Trench, Baja California," *Bull. USNM* (1967); "Gammaridean Amphipods of the Rocky Intertidal of California: Monterey Bay to La Jolla," *Bull. USNM* (1969); "The Families and Genera of the Marine Gammaridean Amphipoda," *Bull. USNM* (1969).

THOMAS E. BOWMAN, Curator, Division of Crustacea; Adjunct Lecturer in Zoology, George Washington University. 1941: B.S., Harvard; 1948: M.A., California, Berkeley;

1954: Ph.D., California, Los Angeles; 1948–1953: Graduate Research Biologist, Scripps Institution of Oceanography; 1954: Assistant Professor of Marine Biology, University of Rhode Island. Specialty: taxonomy and distribution of hyperiid amphipods, calanoid copepods, cymothoid isopods, troglobitic cirolanid isopods. Fieldwork: South Pacific, West Indies. Articles: "Isopodos Quimotoideos Parasitos de Peces de las Aguas Venezolanas," *Mem. Soc. Cien. Nat. LaSalle* (1957); "The Pelagic Amphipod Genus *Parathemisto* (Hyperiidea: Hyperiidae) in the North Pacific and Adjacent Arctic Ocean," *Proc. USNM* (1960); "Description and Notes on the Biology of *Lironeca puhi,* n.sp. (Isopoda: Cymothoidae), "Parasite of the Hawaiian Moray Eel, *Gymnothorax eurostus* (Abbott)," *Crustaceana* (1960); "*Antrolana lira*, a New Genus and Species of Troglobitic Cirolanid Isopod," *Int. J. Speleology* (1964); "Planktonic Copepods from Bahia Fosforescente, Puerto Rico, and Adjacent Waters," *Proc. USNM* (1965).

ISABEL C. CANET, (Pérez Farfante), Systematic Zoologist, Bureau of Commercial Fisheries Systematics Laboratory, and Research Associate, Division of Crustacea. 1938: B.A., La Habana; 1944: M.S., Radcliffe; 1948: Ph.D., Radcliffe; 1940–1942, 1948–1960: Professor of Zoology, Universidad de La Habana; 1959–1960: Director, Centro de Investigaciones Pesqueras (Fisheries Research Center), Havana. Specialty: systematics and zoogeography of shrimps, particularly of the penaeids. Fieldwork: western Atlantic, tropical-subtropical eastern Pacific. Book: *Nueva Zoologia,* Public. Cultural (1963). Articles: "Los camarones commerciales de Cuba," *Contribnes. Cent. Invest. Pesq.* pt. I (1953), pt. II (1954); "Datos sobre la biologia pesquera del camaron *Penaeus duorarum* Burkenroad," *Inst. cub. Invest. Tec., Ser. Est. Trab. Invest.* No. 2 (1961); "Hallazgo de *Trachypeneus (Trachysalambria) constrictus* en el Golfo de Batabano," *Cent. Invest. Pesq. Notas sobre Invest.* No. 1 (1961); "A New Species and Two New Subspecies of Shrimp of the Genus *Penaeus* from the Western Atlantic," *Proc. Biol. Soc. Wash.* (1967). Speaks Spanish.

FENNER A. CHACE, JR., Senior Zoologist. 1930: B.A., Harvard; 1931: M.A., Harvard; 1934: Ph.D., Harvard; 1934–1942: Assistant Curator of Marine Invertebrates, Museum of Comparative Zoology, Harvard University; 1942–1946: Curator of Crustacea, Museum of Comparative Zoology. Specialty: taxonomy, morphology, and distribution of decapod crustacea; current research on decapods of the Smithsonian–Bredin Caribbean Expeditions of 1956, 1958, 1959, 1960. Fieldwork: Sargasso Sea; Bermuda, Sanibel Island, Fla., Lesser Antilles. Articles: "The Bathypelagic Caridean Crustacea. Plankton of the Bermuda Oceanographic Expeditions. IX," *Zoologica* (1940); "Galatheidea. The Anomuran Crustacea. I. Reports on the Scientific Results of the Atlantic Expeditions to the West Indies, etc," *Torreia* (1942); "The Oceanic Crabs of the Genera *Planes* and *Pachygrapsus,*" *Proc. USNM* (1951); "Porcellanid Crabs," *Res. sci. Exped. oceanogr. Belge, . . . (1948–1949)* (1956); "The Non-Brachyuran Decapod Crustaceans of Clipperton Island," *Proc. USNM* (1962); "Decapod Crustaceans from St. Helena Island, South Atlantic," *Proc. USNM* (1966); "The Freshwater and Terrestrial Decapod Crustaceans of the West Indies with Special Reference to Dominica," *Bull. USNM* (1969).

ROGER F. CRESSEY, Associate Curator, Division of Crustacea. 1956: B.A., Boston; 1958: M.A., Boston; 1965: Ph.D., Boston; Adjunct Lecturer in Biology, George Washington University. 1964–1965: Instructor in Biology, Boston University. Specialty: systematics of parasitic copepods; current research on copepods parasitic on pelagic fishes, particularly sharks, tuna, and bullfishes. Fieldwork: Indian Ocean; Madagascar; Cape Haze Marine Laboratory, Fla.; southeastern Pacific off Chile and Peru. Articles: "A New Genus of Copepod Parasitic on a Thresher Shark in Madagascar," *Cahires orstom oceanographie* (1963); "A New Species of *Dentigryps* from Madagascar," *Proc. Biol. Soc. Washington* (1966); *Bariaka alopiae* n. gen., n. sp. (Copepoda, Caligoida), a Parasite on the Gills of a Thresher Shark," *Bul. Mar. Sci.* (1966); "Copepods Parasitic on Sharks of the Indian Ocean," *Proc. USNM* (1967); "A Revision of the Family Pandaridae (Copepoda, Caligoida)," *Proc. USNM* (1967); "Caligoid Copepods Parasitic on *Isurus oxyrinchus,*" Proc. USNM (1968); "Copepods Parasitic on Needle Fishes," *Fisheries Bulletin* (1969); "Parasitic Copepods as a Source of Food for Echeneid Fishes," *Copeia* (1969). Speaks French.

HORTON H. HOBBS, Jr., Senior Zoologist. 1935: B.S., Florida, also studied at Virginia: 1936: M.S., Florida; 1940: Ph.D., Florida; 1937–1946: Instructor, Assistant and Associate Professor, University of Florida; 1946–1955: Associate Professor, Mt. Lake Biological Station, University of Virginia; 1955–1962: Professor, Mt. Lake Biological Station; 1956–1960: Director, Mt. Lake Biological Station. Specialty: systematics, zoogeography, ecology, and evolution of freshwater crayfishes and entocytherid ostracods; current research on systematics, zoogeography, ecology, and evolution of North American freshwater crayfishes and their epizootic ostracods, and on freshwater and terrestrial decapod crustaceans of Dominica. Fieldwork: southeastern United States, Mexico, Dominica. Book: with Fenner A. Chace, Jr., *The Freshwater and Terrestrial Decapod Crustaceans of the West Indies with Special Reference to Dominica, Bull. USNM* (1969). Articles: "The Evolutionary History of the Pictus Group of the Crayfish Genus *Procambarus* (Decapoda, Astacidae)," *Quart. Journ. Fla. Acad. Sci.* (1958); with G. H. Penn, "A Contribution toward a Knowledge of the Crawfishes of Texas *(Decapoda, Astacidae)," Texas Journ. Sci.* (1958); with C. W. Hart, Jr., "The Freshwater Decapod Crustaceans of the Apalachicola Drainage System in Florida, Southern Alabama and Georgia," *Bul. Fla. State Mus.* (1959); "Notes on the Affinities of the Members of the Blandingii Section of the Crayfish Genus *Procambarus (Decapoda, Astacidae)," Tulane Stud. Zool.* (1962); with Alejandro Villalobos, "Los Cambarinos de Cuba," *Anales del Inst. de Biologia,* Univ. de Mexico (1964); with Perry C. Hoit and Margaret Walton, "The Crayfishes and Their Epizootic Ostracod and Branchiobdellid Associates of the Mountain Lake, Virginia Region." *Proc. USNM* (1967); "Crustacea: Malacostraca," in Parrish, *Keys to Water Quality Indicative Organisms (Southeastern United States)* (1968).

W. DUANE HOPE, Associate Curator, Division of Worms; Lecturer, Biological Sciences, George Washington University; Associate Member of the Graduate Faculty, Rutgers University. 1957: B.S., Colorado State; 1960: M.S., Colorado State; 1965: Ph.D., California. Research Assistant, Department of Nematology, University of California, Davis. Specialty: systematics and morphology of marine nematodes. Fieldwork: Marine Biological Laboratory, Woods Hole, Mass.: coast of central and southern California; East Pakistan; Egypt. Articles: "A Review of the Genus *Pseudocella* Filipjev, 1927 (Nematoda: Leptosomatidae) with a Description of *Pseudocella triaulolaimus* n. sp.," *Proc. Helminth. Soc. Wash.* (1967); "Free-living marine nematodes of the genera *Pseudocella* Filipjev, 1927. *Thoracostoma* Marion, 1870, and *Deontostoma* Filipjev, 1916, (Nematoda: Leptosomatidae) from the West Coast of North America," *Trans. Microsc. Soc.* (1967); with K. A. Wright, "Elaborations of the cuticle of *Acanthonchus duplicatus* Wieser, 1969 (Nematoda: Cyatholaimidae) as revealed by light and electron microscopy," *Canadian Journal of Zoology* (1969); "Fine Structure of the Somatic Muscles of the Free-living marine nematode *Deontostoma californicum* Steiner and Albin, 1933 (Leptosomatidae)," *Proc. Helminth. Soc. Wash.* (1969); with D. G. Murphy, "*Rhaptothyreos typicus* n. g., n. sp., An abyssal marine nematode representing a new family of uncertain taxonomic position," *Proc. Biol. Soc. Washington* (1969).

MEREDITH L. JONES, Curator, Division of Worms; Adjunct Lecturer in Biological Sciences, George Washington University. 1948: B.A., California; 1952: M.A., California; 1956: Ph.D., California; 1956–1957: Instructor in Zoology, University of California; 1957–1960: Research Associate, Oceanographic Institute, Florida State University; 1960–1964: Assistant Curator, American Museum of Natural History; Summers 1966, 1967, 1968: Instructor, Marine Biological Laboratory, Woods Hole. Specialties: taxonomy and systematics of the polychaetous annelids, spatial distribution of benthic invertebrates. Current research on systematics and zoogeography of the polychaetous annelids of the Gulf of Mexico and the Caribbean; analysis of spatial relationships of benthic invertebrates off Pt. Richmond, San Francisco Bay, California. Fieldwork: California coast (including certain Channel Islands); Florida and Texas Gulf Coast; Mexican Gulf coast; Hawaii, Chile and Straits of Magellan; Isla Margarita, Venezuela; Bimini and Andros, Bahamas; Dominican Republic; Santa Catarina Island, Brazil. Articles: "A Quantitative Evaluation of the Benthic Fauna off Point Richmond, California," *Univ. Calif. Pub. Zool.* (1961); "Two New Polychaetes of the Families Pilargidae and Capitellidae from the Gulf of Mexico," *Am. Mus. Novitates* (1961); "*Lightiella serendipita* gen. nov., sp. nov., a Cephalocarid from San Francisco Bay, California," *Crustaceana* (1961); "On Some Polychaetous Annelids from Jamaica, the West Indies," *Bul. Am. Mus. Nat. Hisst.* (1962); "Four New Species of Magelona (Annelida, Polychaeta) and a Redescription of *Magelona longicornis* Johnson," *Am. Mus. Novitates* (1963); "On the Morphology of the Nephridia of *Nereis limnicola* Johnson," *Biol. Bul.* (1967); "On the Morphology, Feeding, and Behavior of *Magelonia* sp.," *Biol. Bul.* (1968). Speaks Spanish.

ROMAN KENK, Research Associate, Division of Worms. 1921: Ph.D., Graz, Austria; 1921–1938: Assistant and Associate Professor of Zoology, University of Ljubljana, Yugoslavia; 1938–1948: Associate Professor and Professor of Biology, University of Puerto Rico; 1948–1965: Supervisory Biological Scientist, Library of Congress; 1967–1970: Senior Scientist, George Washington University. Specialty: Morphology, ecology, taxonomy, and physiology of freshwater triclads of North America. Fieldwork: southern Europe, North America. Book: *Marine Borers: An Annotated Bibliography* (1963). Articles. "Beitrage zum System der Probursalier (Tricladida paludicola)," *Zool. Anz.* (1930); "Studies on Virginian Triclads," *J. E. Mitchell Scient. Soc.* (1935); "The Freshwater Triclads of Michigan," *Misc. Pub. Mus. Zool. U. Mich.* (1944); "The Animal Life of Temporary and Permanent Ponds in Southern Mich.," *Misc. Pub. Mus. Zool. U. Mich.* (1949); "The Freshwater Triclads (Turbellaria) of Alaska," *Proc. USNM* (1953); "Species Differentiation and Ecological Relations of Planarians," *Chemistry of Learning* (1968); "Freshwater Triclads (Turbellaria) of North America, I. The Genus *Planaria,*" *Proc. Biol. Soc. Washington* (1969). Speaks Spanish, German, Slovenian.

LOUIS S. KORNICKER, Curator, Division of Crustacea; Adjunct Lecturer in Biology, George Washington University. 1941: B.S., Alabama; 1942: B.S.Ch.E., Alabama; 1954: M.A., Columbia; 1957: Ph.D., Columbia; 1957–1960: Marine Geologist and

Assistant Director, Institute of Marine Science, The University of Texas; 1960–1961: Geologist (scientific liaison), Office of Naval Research; 1961–1964: Associate Professor and Professor of Oceanography, Texas A. and M. University. Specialty: ostracoda systematics and ecology; current research on systematics of ostracoda in the suborder Myodocopida and Ostracoda of the Antarctic Ocean. Fieldwork: Indian Ocean, Bahamas, Gulf of Mexico, Caribbean Sea, Red Sea, Mediterranean Sea. Articles: "Ecology of Ostracoda in the Northwestern Part of the Great Bahama Bank," *Pubbl. staz. zool. Napoli* (1964); "A Seasonal Study of Living Ostracoda in a Texas Bay (Redfish Bay) Adjoining the Gulf of Mexico," *Pubbl. staz. zool. Napoli* (1964); "A New Species of Luminescent Ostracoda from Jamaica, West Indies," *Micropaleontology* (1965); "*Euphilomedes arostrata*, New Myodocopid Ostracod from the Maldive Islands, Indian Ocean," *Proc. USNM* (1967); "Supplementary Description of the Myodocopid Ostracod *Euphilomedes multichelata* from the Great Bahama Bank," *Proc. USNM* (1967); "Supplementary Descriptions of Two Myodocopid Ostracods from the Red Sea," *Proc. USNM* (1967); "A Study of Three Species of *Sarsiella* (Ostracoda: Myodocopa)," *Proc. USNM* (1967); "The Myodocopid Ostracod Families Philomedidae and Pseudophilomedidae (New Family)," *Proc. USNM* (1967); with T. E. Bowman, "Two New Crustaceans: The Parasitic Copepod *Sphaeronellopsis monothrix* (Chioniostomatidae) and its Myodocopid Ostracod Host *Parasterope pollex* (Cylindroleberidae) from the Southern New England Coast," *Proc. USNM* (1967); "Bathyl Myodocopid Ostracoda from the Northeastern Gulf of Mexico," *Proc. Biol. Soc. Washington* (1968); with W. R. Bryant, "Sedimentation on Continental Shelf of Guatamala and Honduras," *American Association of Petroleum Geologists Memoir II* (1969); "Station Data on Ostracoda Collected by the "Travailleur" and "Talisman" (1881–1883)," *Crustaceana* (1969).

RAYMOND B. MANNING, Chairman, and Curator, Division of Crustacea; Adjunct Professor, Institute of Marine Sciences, University of Miami. 1956: B.S., Miami; 1959: M.S., Miami; 1963: Ph.D., Miami; 1959–1963: Research Instructor, Institute of Marine Science, University of Miami. Specialty: systematics of stomatopod and decapod crustaceans; current research on systematics of stomatopod crustaceans of the world. Fieldwork: West Africa, Caribbean, Florida, West Pakistan. Articles: "Notes on the Caridean Shrimp, *Rhynchocinetes rigen* Gordon *(Crustacea, Decapoda)*, in the Western Atlantic," *Notulae Naturae* (1961); "A Redescription of the Palaemonid Shrimp, *Leander paulensis* Ortmann, Based on Material from Florida," *Bul. Bar. Sci. Gulf & Carib.* (1962); "Stomatopod Crustacea Collected by the Yale Seychelles Expedition, 1957–1958," *Postilla* (1962); "The East American Species of *Gnatho-Phyllum* (Decapoda, Gnathophyllidae), with the Description of a New Species," *Crustaceana* (1963); "Preliminary Revisions of the Genera *Pseudosquilla* and *Lysiosquilla* with Descriptions of Six New Genera," *Bul. Mar. Sci. Gulf & Carib.* (1963); "Stomatopoda from the Collection of His Majesty The Emperor of Japan," *Crustaceana* (1965); "Stomatopod Crustacea from the Western Atlantic," *Studies in Tropical Oceanography* (1969).

JOSEPH P. E. MORRISON, Associate Curator, Division of Mollusks. 1926: B.S., Chicago; 1929: M.S., Wisconsin; 1931: Ph.D., Wisconsin. Specialty: systematics and distribution of American land and freshwater mollusks and brackish water mollusks of the world. Current research on freshwater family Hydrobiidae of North America and freshwater fauna of Thailand; brackish water mollusks of North America and New Caledonia; freshwater mussels of America and Asia. Fieldwork: North America

367-637 O - 69 - 11

east of the Mississippi River as well as Quebec and New Brunswick; Kansas; Missouri; California; Baja California; Nevada; Kartabo, British Guiana; San Jose Island, Panama, Eniwetok, Bikini, Rongelap, and Rongerik Atolls; Marshall Islands; Raroia Atoll, Tuamotu Islands; New Caledonia; Dominica, B.W.I.: Fiji; Cook Islands; Tahiti; Society Islands; Oahu, Hawaii; Mexico. Articles: "Formation of an Epiphragm and True Aestivation in Melampidae," *Nautilus* (1964); "Notes on American Melampidae," *Nautilus* (1964); "New Brackish Water Mollusks from Louisiana," *Proc. Biol. Soc. Washington* (1965); "Notes on the Genera of Hipponicidae," *Am. Mal. Union, Ann. Rpt. 1965* (1965); "On the Families of Turridae," *Am. Mal. Union, Ann. Rpt. 1966* (1967). Speaks French.

DAVID L. PAWSON, Curator, Division of Echinoderms. 1960: B.S., Victoria, Wellington, New Zealand; 1961: M.S., Victoria; 1964: Ph.D., Victoria. Adjunct Lecturer in Zoology, George Washington University; Adjunct Professor, Institute of Marine Sciences, University of Miami; 1961–1962: Demonstrator, Department of Zoology, Victoria University, Wellington, New Zealand; 1962–1963: Teaching Fellow, Department of Zoology, Victoria University; 1963–1964: Lecturer, Department of Zoology, Victoria University. Specialty: Echinodermata, particularly Holothuridea and Echinoidea. Fieldwork: Antarctic, Chile, New Zealand, Australia; current research on holothurians of Southern Oceans; Indian Ocean echinoids and holothurians; structure of echinoderm skeleton. Articles: with H. B. Fell, "Phylogeny and Evolution of Holothurians," "Echinacea" in *Treatise on Invertebrate Paleontology, Part U* (1966); "The Ecology of Holothurians" in *Physiology of Echinodermata* (1966); "The Echinoidea Collected by the Royal Society Expedition to Southern Chile, 1958–1959," *Pac. Sci.* (1966); "The Psolid Holothurian Genus *Lissothuria*," *Proc. USNM* (1967); "The Echinozoan Fauna of the New Zealand Subantarctic Island, Macquarie Island and the Chatham Rise," *N.Z. Oceano. Inst. Mem.* (1968); "Rotifers, gastrotrichs, kinorhynchs" and "Prispulids," in Parker and Haswell, *Textbook of Zoology*, Vol. I (7th ed., 1969).

MARIAN H. PETTIBONE, Curator, Division of Worms. 1930: B.S., Linfield; 1932: M.S., Oregon; 1947: Ph.D., Washington; 1949–1953: Research Associate, Johns Hopkins University and Office of Naval Research; 1953–1963: Assistant and Associate Professor, University of New Hampshire. Specialty: taxonomy and systematics of marine polychaete worms; current research on systematics of marine polychaete worms, particularly of the Arctic and New England regions, and polynoid genera of the world. Fieldwork: Puget Sound, Wash., Dillon Beach, Cal.: Maine; New Hampshire; Massachusetts; Gaspé, Quebec. Book: *Some Scale-Bearing Polychaetes of Puget Sound and Adjacent Waters* (1953). Articles: "Marine Polychaete Worms from Point Barrow, Alaska, with Additional Records from the North Atlantic and the North Pacific," *Proc. USNM* (1954); "Endoparasitic Polychaetous Annelids of the Family Arabellidae with Descriptions of New Species," *Biol. Bul.* (1957); "Revision of Some Genera of Polychaete Worms of the Family Spionidae Including the Description of a New Species of *Scolelepis*," *Proc. Biol. Soc. Washington* (1963); "Marine Polychaete Worms of the New England Region. Part I," *Bul. USNM* (1963); "Revision of the Pilargidae *(Annelida: Polychaeta)*, Including Descriptions of New Species and Redescription of the Pelagic *Podarmus ploa* Chamberlin *Polynoidae)*," *Proc. USNM* (1966).

HARALD A. REHDER, Senior Zoologist. 1929: B.A., Bowdoin; 1933: M.A., Harvard; 1934: Ph.D., George Washington; Adjunct Lecturer in Biological Sciences, George Washington University. Specialty: malacology, especially the taxonomy and zoogeography of marine mollusca; current research on taxonomy and zoogeographical relationships of littoral marine mollusks of Polynesia. Fieldwork: eastern Cuba and Navassa Island; southeastern U.S.; Yucatan Peninsula, Mexico; Jaluit Atoll, Marshall Islands; Tahiti; Fiji; French Polynesia; Pitcairn Islands. Book: with W. H. Dall, Paul Bartsch, *A Manual of the Recent and Fossil Marine Pelecypod Mollusks of the Hawaiian Islands* (1938). Articles: "A New Genus and Species of Squids from the Philippines," *Proc. Biol. Soc. Washington* (1945); "The Genus *Turicula* Dall," *Proc. Malac. Soc. London (1955);* "The Pleistocene Mollusks of Grand Cayman Island, with Notes on the Geology of the Island," *Journ. Paleontology* (1962); "Contribucion al Conocimiento de los Moluscos Marinos del Archipielago de Los Rocques y La Orchila," *Memoria de la Sociedad de Ciencias Naturales La Salle* (1962); "Valid Zoological Names in the Portland Catalogue," *Proc. USNM* (1967); "*Volutocorbis* and *Fusivoluta,* two Genera of Deepwater Volutidae from South Africa," *The Veliger* (1969). Speaks German, French, Spanish.

MARY E. RICE, Associate Curator, Division of Worms; Adjunct Associate Professor, Institute of Marine Sciences, University of Miami. 1947: B.A., Drew; 1949: M.A., Oberlin; 1966: Ph.D., Washington; 1949–1950: Instructor in Zoology, Drew University; 1950–1953: Research Associate, College of Physicians and Surgeons, Columbia University; 1953–1961: Research Assistant, National Institutes of Health. Specialty: taxonomy and development of the Sipuncula. Current research on comparative development of *Phascolosoma, Golfingia,* and *Themiste* (Sipuncula); biology of rock-boring sipunculids; development and distribution of planktonic sipunculid larvae, especially *Pelagosphaera.* Fieldwork: Washington coast and Straits of Juan de Fuca; Ceylon, Maldives, and India; Puerto Rico, Barbados, and Curacao.

CLYDE F. E. ROPER, Associate Curator, Division of Mollusks; Adjunct Lecturer in Biological Sciences, George Washington University, and Adjunct Associate Professor, Institute of Marine Sciences, University of Miami. 1959: B.A., Transylvania; 1962: M.S., Institute of Marine Sciences, University of Miami; 1967: Ph.D., Institute of Marine Sciences; 1964–1966: Research Assistant, Institute of Marine Sciences, University of Miami. Specialty: systematics, zoogeography, and ecology of the Cephalopoda, with particular emphasis on oceanic forms. Fieldwork: western Atlantic, Straits of Florida, Tongue of the Ocean, Bahamas, Gulf of Mexico; eastern Pacific (Panama, Colombia, Ecuador, Chile); Gulf of Guinea, West Africa; Southern Ocean (Pacific Sector); current research on Ocean Acre Project–a systematic-ecology study of the pelagic fauna east of Bermuda; monograph of the Ommastrephidae. Techniques: standard oceanographic instruments and collecting gear. Articles: "Observations on Bioluminescense in *Ommastrephes pteropus* (Steenstrup 1855), with Notes on Its Occurrence in the Family Ommastrephidae (Mollusca: Cephalopoda)," *Bul. Mar. Sci. Gulf & Carib.* (1963); "A Note on Egg Deposition by *Doryteuthis plei* (Blainville 1823) and Its Comparison with Other North American Loliginid Squids," *Bul. Mar. Sci.* (1965); "A Study of the Genus *Enoplotheuthis* (Cephalopoda: Oegopsida) in the Atlantic Ocean with a Redescription of the Type Species, *E. leptura* (Leach 1817)," *Dana Rpt.* (1966); with R. E. Young, "The Batoteuthidae, a New Family of Squid (Cephalopoda: Oegopsida) from the Antartic Ocean," *Antarctic Res. Series* (1967); with R. E. Young, "A Review of the Valbyteuthidae (Cephalopoda: Oegopsida) and an Evaluation of Its Relationship with the

Chiroteuthidae," *Proc. USNM* (1967); "Systematics and Zoogeography of the Worldwide Squid Genus *Bethyteuthis* (Cephalopoda: Oegopsida) *Bul. USNM.* (1969); with R. E. Young and G. L. Voss, "An Illustrated Key to the Families of the Order Teuthoidea (Cephalopoda)" (in press); with R. E. Young, "A Monograph of the Cephalopoda of the North Atlantic. The Family Joubiniteuthudae" (in press); with R. E. Young "A Monograph of the Cephalopoda of the North Atlantic. The Family Cycloteuthidae" (in press). Speaks German.

JOSEPH ROSEWATER, Curator, Division of Mollusks; Adjunct Lecturer in Biological Sciences, George Washington University. 1950: B.S., New Hampshire; 1956: M.S., New Hampshire; 1960: Ph.D., Harvard; 1953–1954: Instructor in Zoology, Mt. St. Mary College; 1959: Assistant, Department of Mollusks, Museum of Comparative Zoology. Specialty: malacology (systematics and zoogeography of mollusks); current research on systematics and zoogeography of Indo-Pacific marine mollusca. Fieldwork: New England, southeastern U.S., Hawaii, Marshall Islands, Malaysia, Thailand, Indonesia, western Australia. Articles: with R. D. Turner, "The Family Pinnidae in the Western Atlantic," *Johnsonia* (1958); "The Family Pinnidae in the Indo-Pacific," *Indo-Pac. Mollusca* (1961); "The Family Tridacnidae in the Indo-Pacific," *Indo-Pac. Mollusca* (1965); "The Giant Clams," *Austr. Nat. Hisst.* (1966); "Indo-West Pacific Littorinidae," *Bul. Am. Malacological Union* (1967); "The Zoological Taxa of W. H. Dall," *Bul. USNM* (1968); "The Voyage of H.M.S. Blossom," *Veliger* (1968); "Notes on Periplomatidae (Pelecypoda: Anomalodesmata) with a Geographical Checklist," *Bul. American Malacological Union* (1968); "Gross Anatomy and Classification of *Caledoniella Montrouzieri* Souverbie," *Veliger* (1969). Speaks Spanish, French, German.

KLAUS RUETZLER, Associate Curator, Division of Echinoderms. 1955: Matura, Realgymnasium, Vienna; 1963: Ph.D., Vienna; Adjunct Associate Professor, Institute of Marine Sciences, University of Miami; 1963, Research Assistant, Museum of Comparative Zoology, Harvard University; 1964–1965: Research Associate, Zoological Institute, University of Vienna. Specialty: systematics and ecology of lower marine invertebrates, particularly porifera (sponges). Current research on systematics of Meditteranean, Indo-Pacific, and Caribbean shallow water sponges; relationships between sponges and associated organisms; physiological ecology of benthic organisms. Fieldwork: Mediterranean Sea, eastern and western Indian Ocean, Caribbean Sea. Articles: with K. Russ, "Zur Kenntnis der Schwammfauna unterseeischer Hohlen," *Pubbl. staz. zool. Napoli* (1959); "Aspects of Littoral Life in the Indian Ocean," *Atti del Seminario* (1963); "Systematik und Ocologie der Poriferen aus Littoral–Schattengebieten der Nordadria," *A. Morphol. Okol. Tiere* (1965); "Substratstabilitat als okologischer Faktor, dargestellt am Beispiel adriatischer Porifera," *Int. Revue ges. Hydrobiol.* (1965); "Die Poriferen einer sorrentiner Hohle," *Zool. Anz.* (1966); with H. Fostner, "Problems and Methods of Microclimatic Measurements in the Marine Littoral," (1968); "Freshwater Sponges from New Caledonia," *Cahiers de l'ORSTROM* (1968); "*Loxosomella* (Entroprocta) from *Tedania ignis,* the Caribbean Fire Sponge," *Proc. USNM* (1968); "The Mangrove Community, Aspects of its Structure, Faunistics and Ecology," *Proc. Sym. Coastal Lagoons,* Mexico (1968); with K. Towe, "Lepidocrocite Iron Mineralization in Keratose Sponge Granules," *Science* (1968); with H. Forstner, "Two Temperature-compensated current Meters for Use in Marine Ecology," *Journ. Marine Research* (1969). Speaks German.

WALDO LASALLE SCHMITT, Zoologist Emeritus. 1913: B.S., George Washington; 1916: M.A., California; 1922: Ph.D., George Washington; 1948: D.Sc. (hon), Southern

California. Specialties: taxonomy and systematics of decapod crustacea, marine biology, fisheries, oceanography. Fieldwork: Pacific (California, Oregon, Washington, British Columbia, Alaska, Aleutian Peninsula, Kodiak, Shumagins, west coasts of Mexico, Central and South America, Revillagigedo, Secas, Galapagos Islands, Clipperton, Cocos, Midway, Tahiti, and French Society Islands); Atlantic–Pacific (east and west coasts of South America and off-lying islands, Falklands, Juan Fernandez, Chiloe, South Shetlands); Atlantic (Florida, Florida Keys, Dry Tortugas, West Indies, Caribbean, Greater and Lesser Antilles, Leeward and Windward Islands, Barbados, Trinidad, Old Providence, Panama, Colombia, Venezuela, Dutch West Indies, Quintana Roo, Yucatan, Bahamas); Africa (Belgian Congo, Uganda, Sudan, Egypt); Europe (England, France, Italy, Germany, Netherlands, Belgium, Austria, Norway, Sweden, Denmark); Antarctica (Palmer Peninsula, Weddell and Bellinghausen Seas, Ross Island, McMurdo Sound). Articles: "The Marine Decapod Crustacea of California," ***Univ. Cal. Publ. Zool.*** **(1921); "Some Remarks on the Biological Phases of Oceanography,"** ***Trans Am. Geophys. Union.*** **(1930); "Crustaceans" in vol. 10,** ***Shelled Invertebrates of the Past and Present*** **(1931, 1965); "Applied Systematics; The Usefulness of Scientific Names of Animals and Plants,"** ***Ann. Rpt. Sm.*** **(1935); "The Stomatopods of the West Coast of America Based on Collections Made by the Allan Hancock Expeditions, 1933–38,"** ***Allan Hancock Pac, Exped.*** **(1940); "The Sun and the Harvest of the Sea,"** ***Ann. Rpt. Sm.*** **1953 (1954). Speaks German.**

DEPARTMENT OF PALEOBIOLOGY

The research of the Department of Paleobiology is aimed toward an understanding of physical and biological environments, evolution, and systematics of fossil animals and plants. For practical purposes, studies in the Department are separated along the usual subject-oriented lines, carried out by Divisions of Vertebrate Paleontology, Invertebrate Paleontology, Paleobotany, and Sedimentology. Various avenues of approach are utilized in the Divisions studying fossils, depending upon the nature of the material. These approaches include structural and functional morphology, anatomy, biochemistry, paleo-environments and environments of deposition, electron microscopy, biometrics, culturing, and stratigraphy. Although morphological studies in the Department tend to deal primarily with preserved hard parts of animals and plants, study of "soft-parts" systems of modern animals contributes to solution of paleontological problems.

The Division of Sedimentology is engaged in a comparative study of the sediments and marine processes of the Atlantic coast of North Carolina with those of the coast of Argentina. The latter phase is a cooperative project with the Argentine navy, the University of Buenos Aires, and the George Washington University.

In general, the scientists of the Department devote themselves to the description of new species, the revision and elaboration of previously described species, the refinement and supplementing of knowledge of classifications, and the reconstruction of fossil animals and plants and their environments, based on studies of their morphology and the sediments enclosing them.

Facilities

The laboratories of the Department are equipped for effective paleontological research.

Suites of Type-Specimens

In addition to these physical facilities, the Department has extensive suites of type-specimens, mostly of American species, of fossil vertebrates, invertebrates, and plants. Type-collections for several of the major taxonomic groups are the largest in the world. These suites of types constitute the most valuable and most important part of the national collection of fossils. They are available for use in comparative studies in taxonomy.

Complementing the type-collections, the Department has extensive and varied collections of fossils. These are arranged in biologic as well as stratigraphic series. The biologic collections are unusual for their good representation of genera from all parts of the world. The collections of *Foraminifera, Bryozoa, Brachiopoda, Echinodermata,* and Cambrian *Trilobita* are outstanding examples. The collection of vertebrate fossils is large and contains important types from North America. The collection of fossil plants is extensive. It contains fine suites of Upper Paleozoic plants and good representatives of the Mesozoic and Tertiary plants of the Western World.

The greatest opportunities for research in paleobiology are in systematics, for which the extensive type-collection is an important tool; in morphology, for which comparative collections of both fossil and recent forms may be consulted; and in interpretive ecology and evolution, for which comparative collections and a broadly experienced staff are available. Research in sedimentology is primarily on processes and environmental interpretation rather than description. Major effort is devoted to recent marine sediments. The Museum research group is complemented by 27 paleontologists of the U.S. Geological Survey, who work at the museum building and are available for consultation in specialties of animal and plant groups not represented by the Smithsonian staff. They include experts in *Mollusca (Gastropoda,* ammonites, *Bivalvia), Brachiopoda,* corals, *Foraminifera* (large and small), *Ostracoda,* conodonts, Paleozoic plants, and Cenozoic mammals.

Research Staff

WALTER H. ADEY, Associate Curator, Division of Paleobotany. 1955: B.S., Massachusetts Institute of Technology; 1963: Ph.D., Michigan; 1963–1964: Research Associate, Colorado School of Mines. Specialty: marine algae, especially coralline algae; current research on biosystematics and ecology of the crustose corallines of the North Atlantic. Fieldwork: western North Atlantic, Labrador to the Caribbean, eastern North Atlantic, Iceland, Norway to Spain. Special technique: use of SCUBA-diving in algal ecological studies. Book: with P. Lebednik, *Catalog of the Foslie Herbarium.* (1967). Articles: "The Genus *Phymatolithon* in the Gulf of Maine," *Hydrobiologia* (1964); "The Genus *Clathromorphum* in the Gulf of Maine," *Hydrobiologia* (1965); with J. H. Johnson; "Studies of *Lithophyllum* and Related Algal Genera," *Quart. Colo. Sch. of Mines* (1965); "The Genus *Pseudolithophyllum*(Corallinaceae) in the Gulf of Maine," *Hydrobiologia* (1966); "The Genera *Lithothamnium, Leptophytum* (nov. gen.) and *Phymatolithon* in the Gulf of Maine," *Hydrobiologia* (1966); "The distribution of saxicolous crustose corallines in the northwestern North Atlantic," *Journ. Phycology* (1966); "The distribution of crustose corallines on the Icelandic Coast," *Soc. Sci. Islandica* (1968).

RICHARD H. BENSON, Curator, Division of Invertebrate Paleontology; Professor of Geology, University of Kansas. 1951: B.S., Marshall; 1953: M.S., Illinois; 1955: Ph.D., Illinois; 1951–1956: Associate Geologist, Illinois Geological Survey; 1955–1969: Assistant Professor of Geology, University of Kansas; 1960–1964: Associate Professor of Geology, University of Kansas. Specialties: marine geology, paleontology of ostracodes; current research on history of Neogene ostracode and their significance in the solution of geological problems; abyssal and deep-sea Ostracoda, fossil and living of the world. Fieldwork: eastern Pacific, Gulf of Mexico, western Atlantic, Mediterranean, Indian and Southern Oceans, midwestern United States, High Plains region. Special technique: Use of the scanning electron microscope in ostracode research. Articles: "Recent Cytheracean Ostracodes from McMurdo Sound and the Ross Sea, Antarctica, *"Univ. Kansas Paleont. Contr.* (1964); "Recent Podocopid and Platycopid Ostracodes of the Pacific" in *Ostracods as Ecological and Paleoecological Indicators.* Publ. staz. zool. Napoli (1964); "photography of Microfossils" in *Handbook of Paleontological Technqiues* (1965); "Recent Marine Podocopid Ostracodes," *Oceanogr. Mar. Biol. Ann. Rev.* (1966); "Muscle-scar Patterns of Pleistocene (Kansan) Ostracodes," in *Essays in Paleontology and Stratigraphy* (1967).

RICHARD S. BOARDMAN, Curator, Division of Inverterbrate Paleontology. 1948: B.S., Illinois; 1952: M.S., Illinois; 1955: Ph.D., Illinois; 1952–1957: Geologist, U.S. Geological Survey. Specialty: Paleozoic to Recent Stenolaemate Bryozoa, their taxonomy, functional morphology, and evolution. Current research on Bryozoan fauna of Simpson group, M. Ordovician, Arbuckle Mountains, Okla.; revision of Bryozoan chapter of treatise on invertebrate paleontology; recent and post-Paleozoic cyclostome evolution. Fieldwork: New York, Ohio, Indiana, Kentucky, Oklahoma, Scandinavia, southern Appalachians, British Isles. Special techniques: making of preparations of fossil and Recent Bryozoa and their photography. Articles: "Bryozoa," in "Developments, Trends, and Outlooks in Paleontology" series, *Journ. Paleontology* (1968); "Potential Use of Paleozoic Bryozoa in Subsurface Exploration," *Atti Soc. Italian Sci. Nat. St. Nat. Milano* (1968); "Colony Development and Convergent Evolution of Budding Pattern in 'Rhombotrypid' Bryozoa," ibid; "Skeletal Growth, Intracolony Variation, and Evolution in Bryozoa; a Review," *Journ. Paleontology* (1969).

MARTIN A. BUZAS, Associate Curator, Division of Invertebrate Paleontology: Associate Professional Lecturer in Geology and Oceanography, George Washington University. 1958: B.A., Connecticut; 1960: M.S., Brown; 1963: Ph.D., Yale. Specialties: Foraminifera, population paleoecology; current research on ecology and paleoecology of

Foraminifera, with particular emphasis on population ecology and statistical methods. Fieldwork: Long Island Sound; Chesapeake Bay; Choptank River, Md.; Rehoboth Bay, Del., central and southern Maine, Cape Cod. Articles: "The Discrimination of Morphological Groups of Elphidium X (Foraminifera) in Long Island Sound through Canonical Analysis and Invariant Characters," *Journ. Paleontology* (1966); "On the Spatial Distribution of Foraminifera," *Cont. Cushman Journ. Foram. Res.* (1968); "An Application of Canonical Analysis as a Method for Comparing Faunal Areas," *Journ. Animal Ecology* (1967); "Foraminifera from the Hadley Harbor Complex, Massachusetts," *Sm. Misc. Coll.* (1968); with J. F. Mello, "An Application of Cluster Analysis as a Method of Determining Biofacies," *Journ. Paleontology* (1968); with T. G. Gibson, "Species Diversity: Benthonic Foraminifera in Western North Atlantic," *Science* (1969). Speaks Hungarian.

ALAN H. CHEETHAM, Curator, Division of Invertebrate Paleontology; Consulting Professor of Geology, Louisiana State University. 1950: B.S., New Mexico Institute of Mining and Technology; 1952: M.S., Louisiana State; 1959: Ph.D., Columbia; 1961–1962: British Museum (Natural History); 1954–1960: Instructor in Geology, Louisiana State University; 1960–1963: Assistant Professor of Geology, Louisiana State University; 1964–1965: Visiting Professor of Geology, University of Stockholm. Specialties: systematics and functional morphology of cheilostome Bryozoa, marine biogeography of the Tertiary. Current research on application of quantitative and numerical methods of cheilostome taxonomy; functional morphology and cheilostomes: evolution of distribution patterns in cheilostomes, evolutionary patterns in functional morphology of cheilostomes. Fieldwork: Tertiary of Gulf Coast (1950–present), of southeastern England (1961), of southern Sweden and Denmark (1964–1965). Book: *Late Eocene Zoogeography of the Eastern Gulf Coast Region,* Geol. Soc. American Mem. 91 (1963). Articles: "Time, Migration, and Continental Drift," *Am. Assoc. Petroleum Geologists Bul.* (1960); "The Polyzoan Genus *Ditaxiporina* Stach," *Annals Mag. Nat. HIst.* (1963); with P. A. Sandberg, "Quaternary Bryozoa from Louisiana Mudlumps," *Journ. Paleontology* (1964); "Cheilostomatous Polyzoa from the Upper Bracklesham Beds (Eocene) of Sussex," *Brit. Bus. (Nat. Hist.) Bul.s, (Geology) (1966);* with J. S. Schlee. "The Rocks of Eocene Age from Fippennies Ledge, Gulf of Maine," *Bul. Geol. Soc. Am.* (1967); "Paleoclimatic Significance of the Bryozoan *Metrarabdotus," Gulf Coast Assoc. Geol. Soc.,* Trans. (1967); "Morphology and Systematics of the Bryozoan Genus *Metrarabdotus," Sm. Misc. Coll.* (1968); "Evolution of Zooecial Asymmetry and Origin of Poricellariid Cheilostomes," *Atti. Soc. Ital. Nat.* (1969); with J. B. Rucker and R. E. Carver, "Wall Structure and Mineralogy of the Cheilostome Bryozoan *Metrarabdotos," Journ. Paleontology* (1969); with R. S. Boardman, "Skeletal Growth, Intracolony Variation, and Evolution in Bryozoa: A Review," *Journ. Paleontology* (1969).

RICHARD CIFELLI, Curator, Division of Invertebrate Paleontology. 1948: B.A., Montana State; 1951: M.A., California, Berkeley; 1959: Ph.D., Harvard; 1951–1955: Geologist, Phillips Petroleum Co.: 1957–1959: Instructor in Geology, Brown University. Specialty: smaller Foraminifera. Current research on recent and Tertiary planktonic Foraminifera, their distribution and relationship to water masses; development of relief and sedimentation on the Mid-Atlantic Range. Articles: "Planktonic Froaminifera from the Western North Atlantic," *Sm. Misc. Coll.* (1965); "Late Tertiary Planktonic Foraminifera Associated with a Volcanic Boulder from the Mid-Atlantic Ridge," *Journ. Marine Res.* (1965); "Age Relationships of Mid-Atlantic Ridge Sediments," *Geol. Soc. America* (1969); "Radiation of Cenozoic Planktonic Foraminifera," *Systematic Zoology* (1969).

G. ARTHUR COOPER, Senior Paleobiologist, Division of Invertebrate Paleontology 1924: B.S., Colgate; 1926: M.S., Colgate; 1953: Sc. D (hon), Colgate; 1929: Ph.D., Yale; 1929–1930: Research Assistant, Yale University. Specialties: Paleontology (Brachiopods, Trilobites), Stratigraphy (Ordovician, Devonian, Permian). Fieldwork: Southwestern U.S. (Texas, New Mexico), Appalachians (Virginia, Tennessee, Georgia, Pennsylvania), New York; current research involving the Glass Mountains, Texas. Special techniques: preparation and photography of fossils. Books: with E. O. Ulrich, *Ozarkian and Canadian Brachiopoda,* Geol. Soc. Amer. Special Papers, no. 13 (1938); *Chazyan and related brachiopods,* Sm. Misc. Coll., vol. 127, 2 pts. (1956); with H. M. Muir-Wood, *Morphology, Classification and Life-habits of the Productoidea (Brachiopoda),* Geol. Soc. Amer. Memoir 81 (1960). Articles: with Charles Schuchert, "Brachiopod genera of the Suborders Orthoidea and Pentameroidea," *Mem. Peabody Mus. Nat. Hist.* (1932); "Brachiopod ecology and paleoecology," *Rept. Committee on Paleoecology, Nat. Res. Council, Div. Geol. and Geogr.* (1937); "Brachiopoda, in Shimer and Shrock," *North American Index Fossils* (1944); "New and unusual species of brachiopods from the Arbuckle group in Oklahoma," *Sm. Misc. Coll.* (1952); "Permian Fauna at El Antimonio, Western Sonora, Mexico," *Sm. Misc. Coll.* (1953); "New genera of Middle Paleozoic brachiopods," *Journ. Paleontology* (1955); "Genera of Tertiary and Recent Rhynchonelloid Brachiopods," *Sm. Misc. Coll.* (1959).

C. LEWIS GAZIN, Senior Paleobiologist. 1927: B.S., California Institute of Technology; 1928: M.S., California Institute of Technology; 1930: Ph.D., California Institute of Technology; 1930–1932: Junior Geologist, U.S. Geological Survey. Specialty: early Cenozoic mammalia. Current research on Eocene and Paleocene mammalian faunas of the Rocky Mountain region, particularly of the middle Eocene Bridger formation; a study of the primates and condylarths in a Paleocene Mammalian fauna from the western part of the Wind River Basin, Wyoming. Fieldwork: 23 expeditions to the western states and central America. Articles: "The Lower Eocene Knight Formation of Western Wyoming and its Mammalian Faunas," *Sm. Misc. Coll.* (1952); "The Tillodontia: An Early Tertiary Order of Mammals," *Sm. Misc. Coll.* (1953); "A review of the Upper Eocene Artiodactyla of North America," *Sm. Misc. Coll.* (1955); "Paleocene Mammalian Faunas of the Bison Basin the South-Central Wyoming," *Sm. Misc. Coll.* (1956); "A Review of the Middle and Upper Eocene Primates of North America," *Sm. Misc. Coll.* (1958); "A Study of the Early Tertiary Condylarthran Mammal *Meniscotherium*," *Sm. Misc. Coll.* (1965). "A study of the Eocene condylarthran mammal *Hyopsodus*," *Smithsonian Misc. Coll.* (1968). Speaks Spanish.

LEO J. HICKEY, Associate Curator, Division of Paleobotany. 1962: B.S., Villanova University, 1964: M.A. Princeton; 1966: Ph.D., Princeton. 1966–1969 Postdoctoral research associate, Smithsonian Institution. Specialty: Tertiary Paleobotany; dicot leaf architecture, western American late cretaceous-early tertiary stratigraphy. Fieldwork: Wyoming, Montana, North Dakota. Current research on Paleobotany, Stratigraphy, Economic Minerals, Paleocene–Eocene Floras of Western United States, leaf architecture in the identification of Dicots. Special techniques: Geologic field techniques.

NICHOLAS HOTTON III, Curator, Division of Vertebrate Paleontology. 1947: B.S., Chicago; 1950: Ph.D., Chicago; 1951–1959: Professional Lecturer in Geology, George Washington University. Specialty: fossil amphibian sand reptiles, Paleozoic and early Mesozoic; current research on functional anatomy of therapsids and other reptiles, systematics of the rapsid suborder Dicynodontia, and stratigraphy and sedimentation of the Beaufort Series, South Africa. Fieldwork: Texas, Kansas, West Virginia, South Africa, collecting and field study of Paleozoic tetrapods. Book: *The Evidence of Evolution* (1968). Articles: "A Survey of the Adaptive Relationship of Dentition to Diet in the North American Iguanidae," *Am. Midl. Naturalist* (1955); "The Pelycosaur Tympanum and Early Evolution of the Middle Ear," *Evolution* (1959); "The Chorda Tympani and Middle Ear as Guides to Origin and Divergence of Reptiles," *Evolution* (1960); "Speculations on Upper Beauford Deposition," *J. So. Afr. Assn. Adv. Sci.* (1963); "Stratigraphy & Sedimentation in the Beaufort Series (Permian-Triassic) South Africa" in *Essays in Paleontology & Stratigraphy* (1967); with A. W. Crompton, "Functional Mormphology of the Masticatory Apparatus of Two Dicynodonts (Reptilia, Therapsida)," *Postilla* (1967). Speaks Afrikaans.

FRANCIS M. HUEBER, Curator, Division of Paleobotany; Consultant in Research, Graduate Council, George Washington University. 1956: B.S., Butler U.P.; 1959: M.S., Cornell; 1960: Ph.D., Cornell; 1960–1961: Instructor in Botany, Cornell University; 1961–1962: Paleobotanist, Geological Survey of Canada. Specialties: Paleozoic plant morphology and anatomy. Fieldwork: New York, Wyoming, Maine, Quebec, Prince Edward Island, New Brunswick, Ontario, Alberta, British Columbia, Australia, Fiji, Germany, Scotland. Special techniques: Paleobotanical laboratory techniques. Articles: "The Psilophytes and Their Relationship to the Origin of Ferns," *Mem. Torrey Bot. Club* (1964); with L. M. Carluccio, H. P. Banks, "*Archaeopteris macilenta,* Anatomy and Morphology of Its Frond," *Amer. Journ. Bot.* (1966); with H. P. Banks, "*Psilophyton princeps:* The Search for Organic Connection", *Taxon* (1967); "*Psilophyton:* the Genus and the Concept," *International Symposium on the Devonian System* (1967); "Devonian Lycopods from Northern New Brunswick, with J. D. Grierson, *International Symposium on the Devonian System* (1967).

ERLE G. KAUFFMAN, Curator, Division of Invertebrate Paleontology; Adjunct Professor of Geology, George Washington University. 1955: B.S., Michigan; 1956: M.S., Michigan; 1961; Ph.D., Michigan; 1955–1960: Instructor, Teaching Fellow, Department of Geology, University of Michigan; 1963–1965: Lecturer in Geology, George Washington University. Specialties: systematics, evolution, functional morphology, and ecology of Mesocoic-Cenozoic molluscs, in particular the Bivalvia; Mesozoic-Paleogene stratigraphy. Current research on systematic, evolutionary, and paleoecologic studies of Jurassic, Cretaceous, and Early Cenozoic Bivalvia; biostratigraphic studies of Mesozoic and Early Cenozoic rocks of the Rocky Mountains, Atlantic Coastal Plain, and Caribbean. Fieldwork: western interior of the U.S. Rocky Mountain belt and High Plains, Atlantic Coastal Plain, Michigan, Ohio, Alaska, Gulf Coast area, Arabia, Canada, the Caribbean. Special techniques: use of air abrasive unit, dental drill, diamond saws and lap wheels for preparation of fossils. Articles: with C. E. Stumm, "Calymenid Trilobites from the Ordovician Rocks of Michigan," *J. Paleontology* (1958); with R. V. Kelsing, "An Upper Cretaceous Ammonite Bitten by a Mosasaur," *Cont. Mus. Paleon. Univ. Michigan* (1960); with J. A. Dorr, Jr., "Rippled Toroids from the Napoleon Sandstone Member (Mississippian) of Southern Michigan," *J. Sedimentary Petrology* (1963); with N. F. Sohl, "Giant Upper Cretaceous Oysters from the Gulf Coast and Caribbean," U.S. Geological Survey Professional Paper 483–H (1964); "Middle and Late Turonian Oysters of the *Lopha Lugubris* Group," *Sm. Misc. Coll.* (1965); with D.S. McCulloch, "Biota of a Late Glacial Rocky Mountain Pond," *Bul. Geological Soc. Am.* (1965); "Cretaceous *Thyasira* from the Western Interior of North America," *Sm. Misc. Coll.* (1967); "The Upper Cretaceous *Inoceranmus* of Puerto Rico," *Abstr. Preprints* (1965) and *Proc. 4th*

Caribbean Geol. Conf. (1967); "Coloradoan Macroinvertebrate Assemblages, Central Western Interior, ed. E. G. Kauffman, H. C. Kent, Sym., Spec. Pub. Colorado School of Mines (1967); "Notes on Cretaceous Inoceramidae of Jamaica," *Geonotes, Geol. Soc. Jamaica* (1967); with C. H. Dane and W. A. Cobban, "Semilla Sandstone, a new member of the Mancos Shale in the southeastern part of the San Juan Basin, New Mexico," *U.S. Geol. Survey Bul.* (1968);; "Biostratigraphy and assemblages of Antillean Cretaceous Bivalvia," abstr. and proc. *5th Carib. Geol. Conf.* (1969, and 1970 in press): with C. H. Buddenhagen, "Protandric sexual dimorphism in Paleocene *Astarte* of Maryland," in *Sexual Dimorphism in Fossil Metazoa and Taxonomic Implications,* ed. G.E.G. Westermann (1969); with J. D. Powell and D. E. Hatlin, "Cenomanian-Turonian facies across the Raton Basin," *in Gdbk. Geol. Raton Basin, Rocky Mountain Assn. Geol., Rocky Mtn. Geologist* (1969); "Cretaceous marine cycles of the Western Interior," ibid. *The Mountain Geologist,* (1969); "Form, Function and Evolution," in *Treatise on Invertebrate Paleontology, Bivalvia,* ed. R. C. Moore (1969).

PORTER M. KIER, Chairman, 1950: B.S., Michigan; 1951: M.S., Michigan; 1954: Ph.D., Cambridge: 1956–1957: Associate Professorial Lecturer in Geology, George Washington University. Specialty: living and fossil echinoids. Fieldwork: Arabia, western Europe, southeastern U.S., Florida Keys, Dominica. Articles: "The Tertiary Echinoidea from British Somaliland," *Journ. Paleontology* (1957); "New American Paleozoic Echinoids," *Sm. Misc. Coll.* 1958); "Redescription of Some Lower Carboniferous Echinoids from Belgium," *Inst. royal des sciences naturalles de Belgique, Bul.* (1962); "A Revision of the Cassiduloid Echinoids," *Sm. Misc. Coll.* (1962); "Evolutionary Trends in Paleozoic Echinoids," *Journ. Paleontology* (1965); with R. E. Grant, "Echinoid Distribution and Habits, Key Largo Coral Reef Preserve, Florida," *Sm. Misc. Coll.* (1965); "Four New Eocene Echinoids from Barbados," *Sm. Misc. Coll.* (1966); "A revision of the Oligopygoida," *Sm. Misc. Coll.* (1967); "The Triassic Echinoids of North America," *Journ. Paleontology* (1967); "A Cretaceous Echinoid with false teeth," *Paleontology* (1969); "Sexual Dimorphism in Fossil echinoids," *Schweizerbarth* (1969).

JACK PIERCE, Associate Curator, Division of Sedimentology; Adjunct Professor, George Washington University. 1949: B.S., Illinois; 1950: M.S., Illinois; 1964: Ph.D., Kansas, 1963–1965: Associate Professor of Geology, George Washington University. Specialty: coastal and shallow water sedimentation and processes. Current research on general sedimentation processes along coastline and shallow water; changes in soils induced by vegetation cover changes or causing these changes; sediment dispersal patterns on the continental shelves of the world. Developing theories on the evolution or history of North Carolina offshore barriers and processes leading to their formation; the relation of size differences in sediments resulting from wave energy; sedimentation of continental shelf and coast of Argentina. Fieldwork: coastal North Carolina and Argentina continental shelf. Book: *Fortran II Program for Standard Sediment Size Analysis,* Kansas Geological Survey Special Publ. No. 28 (1967). Article: "Sediment Budget of a Portion of the North Carolina Coast," *southeast section, geol. soc. am. meeting, 13–16 Apr., 1966, abs. in Special Paper of the GSA* (1967); "Dolomite from the Continental Slope off Southern California," *Journ. Sedimentary Petrology* (1967); "Outcrop of the Yorktown Formation (Upper Miocene) in Onslow Bay, North Carolina," *Southeastern Geology* (1967); "Clay Mineralogy in the Estuary of the Rio de la Plata, South America," *Proc. XXIII Int. Geol. Congr.* (1968); "Quantification of Clay Mineral Studies of Sediments and Sedimentary Rocks," *Journ. Sedimentary Petrology* (1969).

CLAYTON E. RAY, Associate Curator, Division of Vertebrate Paleontology. 1955: B.A., Harvard; 1958: M.A., Harvard; 1962: Ph.D., Harvard; Adjunct Associate Professor in Geological Sciences, Virginia Polytechnic Institute; 1959–1963: Assistant Professor and Assistant Curator, University of Florida. Specialties: Later Cenozoic mammals, Marine mammals; current research on quaternary mammals, including various projects on faunas or groups from North America, Antilles, and Mexico. Fieldwork: southeastern U.S., Antilles, Mexico, Mediterranean Islands. Articles: "The Relationships of *Quemisia gravis* (Rodentia: Heptaxodontidae);" *Sm. Misc. Coll.* (1965); with C. W. Hibbard, D. E. Savage, D. W. Taylor, J. E. Guilday, "Quaternary Mammals of North America," in *The Quaternary of the United States* (1965); "A New Chipmunk, *Tamias aristus*, from the Pleistocene of Georgia," *Journ. Paleontology* (1965); with B. N. Cooper, W. S. Benninghoff, "Fossil Mammals and Pollen in a Late Pleistocene Deposit at Saltville, Virginia," *Journ. Paleontology* (1967); "Pleistocene Mammals from Ladds, Bartow County, Georgia,," *Ga. Acad. Sci. Bul.* (1967); with Alexander Wetmore, D. H. Dunkle and Paul Drez, "Fossil Vertebrates from the Marine Pleistocene of Southeastern Virginia," *Sm. Misc. Coll.* (1968). Not in Residence May-September 1970.

DANIEL J. STANLEY, Curator, Division of Sedimentology. 1956: B.S., Cornell; 1958: M.S., Brown; 1961: D.Sc., Grenoble; Professor of Geology, University of Illinois; 1964: Woods Hole Oceanographic Institution; 1962–1963: Assistant to the Director, U.S.A. Corps of Engineers Waterways Experiment Station; 1963–1964: Assistant Professor of Geology, University of Ottawa; 1964–1966: Assistant Professor of Marine Geology, Dalhousie University. Specialties: sedimentology of continental shelf, and slope, and basin, sediments and flysch deposits. Fieldwork: Venezuela, French and Italian Maritime Alps, lower Mississippi Valley, Northwest Atlantic off Maritime Provinces of Canada and New England, Bermuda, Mediterranean; current research on marine geology of the outer Atlantic continental margin, basin deposits of the Mediterranean; Instrumentation and Techniques: marine geological techniques, oceanographic and laboratory facilities available. Book: *Études sédimentologiques des grès d'Annot* (1961). Articles: "Stratigraphy and Foraminifera of lower Tertiary Vidono Shale, near Puerto La Cruz, Venezuela," *Am. Assoc. Petrol. Geol. Bul.* (1960); "Études sédimentologiques des Grès d'Annot et de leurs équivalents lateraux," *Rev. Inst. Franç. Pétrole* (1961); "Vertical Petrographic Variability in Annot Sandstone Turbidites," *Journ. Sed. Petrol.* (1963); "Large Mudstone-nucleus Sandstone Spheroids in Submarine Channel Deposits," *Journ. Sed. Petrol.* (1964); with A. H. Bouma, "Methodology and Paleogeographic Interpretation of Flysch Formations" in *Turbedites* Der. Sed. 3 (1964); "Heavy Minerals and Provenance of Sands in Flysch of the Central and Southern Alps," *Am. Assoc. Petrol. Geol. Bul.* (1965); "Biogenic Graded Bedding," *Journ. Sed. Petrol.* (1965); "Petrology and Stratigraphy Applied to a Problem of River Engineering in Lower Mississippi Delta" in *Geology of Deltas* (1966); with D. C. Rhoads, "Dune Sands Examined by Infrared Photography," *Am. Assoc. Petrol. Geol. Bul.* (1967); with A. E. Cok, "Sediment transport by ice on the Nova Scotian Shelf," *Trans. Marine Technology Society Symposium* (1968); with E. Mutti, "Sedimentological evidence for an emerged land mass in the Ligurian Sea during the Paleogene," *Nature* (1968); "Color of Marine Sediments," *U.S. Geol. Surv. Professional Paper* (1968); with D.J.P. Swift, "Bermuda's reef-front platform: bathymetry and significance," *Marine Geology* (1968); with G. Kelling, "Sedimentation patterns in the Wilmington submarine canyon area," *Trans. Marine Technology Society Symposium* (1968). Speaks French, Spanish.

KENNETH M. TOWE, Associate Curator, Division of Invertebrate Paleontology. 1956: B.A., Duke; 1959: M.S., Brown; 1961: Ph.D., Illinois; 1962–1964: California Institute of Technology; 1961–1962: Research Associate, Electron Microscope Laboratory, University of Illinois. Specialty: electron microscopy: current research on applications of electron microscopy to geology and paleontology. Instrumentation and techniques: electron microscopy and X-ray diffraction. Articles: with C. W. Harper, "Pholidostrophid Brachiopods: Origin of the Nacreous Luster," *Science* (1966); with H. A. Lowenstam, "Ultrastructure and Development of Iron Mineralization in the Radular Teeth of *Cryptochiton stelleri* (Mollusca)," *J. Ultrastructure Res.* (1967); with R. Cifelli, "Wall Ultrastructure in the Calcareous Foraminifera: Crystallographic Aspects and a Model for Calcification," *Journ. Paleontology* (1967); with C. W. Harper, "Shell Structure of the Brachiopod *Pholidostrophia (Mesopholidostrophia) nitens* from Gotland," *Journ. Paleontology* (1967); "Wall Structure and Cementation in *Hapalophragmoides canarensis,*" *Cont. Cushman Found. Froaminiferal Res.* (1967); with W. F. Bradley, "Mineralogical Constitution of Colloidal 'Hydrous Ferric Oxides'," *Journ. Colloid & Interface Sci.* (1967); "Echinoderm Calcite: Single Crystal or Polycrystalline Aggregate," *Science* (1967).

THOMAS R. WALLER, Associate Curator, Division of Invertebrate Paleontology. 1959: B.S., Wisconsin; 1961: M.S., Wisconsin; 1966: Ph.D., Columbia; 1959: Geologist, Mobil de Venezuela: 1961: Intern, Smithsonian. Specialty: Cenozoic Mollusca, particularly speciation, adaptive radiation, and functional morphology in late Cenozoic species-groups. Current research on ecology, functional morphology, and evolution of Upper Cenezoic Pectinidae (scallops) and the effects of former Atlantic-Pacific connections upon the patterns of evolution displayed by this group; molluscan faunal studies of the Norfolk Fm. of Southeastern Virginia, the Charlton Fm. of northern Florida, and the upper Cenozoic marine formations of Venezuela. Fieldwork: Atlantic and Gulf Coastal Plains of the U.S., northern South America, Venezuela. Articles: "The Evolution of the *Argopecten gibbus* stock (Mollusca: Bivalvia), with Emphasis on the Tertiary and Quaternary Species of Eastern North America," *Journ. Paleontology, Memoir 3* (in press).

Department of Paleobiology Honorary Research Associates:

ARTHUR J. BOUCOT, Department of Geology, Oregon State University, Corvallis, Oregon Late Paleozoic Brachiopods and Biostratigraphy, Alaska.

C. WYTHE COOKE, Invertebrate Paleontology, U.S. National Museum, Smithsonian Institution.

J. THOMAS DUTRO, Invertebrate Paleontology, U.S. National Museum, Smithsonian Institution; Chief, Paleontology and Stratigraphy Branch, U.S. Geological Survey, Department of the Interior, Washington, D.C. Late Paleozoic Brachiopods and Biostratrigraphy, Alaska.

MACKENZIE GORDON, Jr., Invertebrate Paleontology, Geologist, U.S. Geological Survey, Department of Interior, Washington, D.C. Upper Paleozoic Cephalopods, North America and upper Paleozoic Faunas and Stratigraphy, western United States.

RICHARD E. GRANT, Invertebrate Paleontology, Geologist, U.S. Geological Survey, Department of Interior, Washington, D.C. Permian Brachiopods, western United States.

JOHN W. HUDDLE, Invertebrate Paleontology, Geologist, U.S. Geological Survey, Department of Interior, Washington, D.C. Conodonts.

RALPH W. IMLAY, Invertebrate Paleontology, Geologist, U.S. Geological Survey, Department of Interior, Washington, D.C. Jurassic of North America.

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SERGIUS H. MAMAY, Invertebrate Paleontology, Geologist, U.S. Geological Survey, Department of Interior, Washington, D.C. Paleozoic floras.

WILLIAM A. OLIVER, Jr., Invertebrate Paleontology, Chief, Lower Paleozoic Unit, Geologist, U.S. Geological Survey, Department of Interior, Washington, D.C. Silurian-Devonian corals and stratigraphy.

NORMAN F. SOHL, Invertebrate Paleontology, Chief, Paleontology and Stratigraphy Branch, U.S. National Museum, Smithsonian Institution; Geologist, U.S. Geological Survey, Department of Interior, Washington, D.C. Mesozoic gastropods.

RUTH TODD, Invertebrate Paleontology, Geologist, Geological Survey, Department of Interior, Washington, D.C. Cenozoic and late Cretaceous small forams.

FRANK C. WHITMORE, Jr., Vertebrate Paleontology, Chief, Vertebrate Paleontology Unit, U.S. National Museum, Smithsonian Institution; Geologist, U.S. Geological Survey, Department of Interior, Washington, D.C. Cenozoic vertebrates.

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DEPARTMENT OF VERTEBRATE ZOOLOGY

Research

The Department of Vertebrate Zoology is a center for research in systematics and related studies in ecology, biogeography, morphology, life histories, and behavior of fishes, amphibians, reptiles, birds and mammals. The worldwide collections of millions of specimens make it possible to prepare taxonomic monographs and revisions and to analyze relationships among the various taxa. Scientists from all over the world study the collections and contribute to the academic atmosphere of the Department.

Although research in the Department is largely based on the collections, ecological, behavioral, and serological studies are now being conducted by Smithsonian scientists and cooperative biomedical programs are under way in Africa, the Middle East, and Latin America. This expansion of the horizons of research in vertebrate zoology does not reduce the importance of taxonomic studies in many groups, nor does it eliminate the continuing need for field collecting, particularly in less well known parts of the world, such as the tropics.

In addition to the research staff of the Smithsonian Institution, personnel of the Fish and Wildlife Service (Bureaus of Commercial Fisheries and Sport Fisheries and Wildlife) conduct research in the Divisions of Fishes, Birds, and Mammals.

The specimens, including major collections of types, constitute the prime material resource of the Department, but in addition, other ancillary research facilities are available. Each of the divisions has a subject-oriented library and extensive reprint collection. Through the Smithsonian library, the book collections of the Library of Congress and Department of Agriculture are also available and constitute a major comprehensive research library system for vertebrate zoology. Two CEIR telecomputer consoles for statistical programs are located in the Department. Other Departmental facilities include a specimen preparation laboratory, both hard and soft X-Ray machines, dark rooms, histological laboratories with provisons for clearing and staining fish skeletons, and compound and dissecting microscopes.

The Chesapeake Bay Center for Field Biology is available for systematics-oriented ecological research on local vertebrates. Planned laboratories and research cages at the National Zoological Park will permit combined programs of museum research and study of live animals.

Fishes

Fishes are taxonomically the least known vertebrates, and research on this group involves to a great extent revisions at the specific, generic, and higher levels. Research in the Division of Fishes, based on what is probably the largest fish collection in the world, is directed mainly toward comprehensive systematic studies of natural groups of marine and fresh water fishes, involving their morphology, classification, relationships, evolution, and distribution. Studies in population dynamics, behavior, life history, ecology, genetics, and cellular and tissue morphology are oriented to specific systematic investigations.

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Reptiles and Amphibians

The extensive collections of the Division of Reptiles and Amphibians facilitate various kinds of herpetological investigations, such as systematic analyses of genera, families, and higher categories; analyses of specific phenomena or structures in large comparative series (such as color patterns in snakes); zoogeographical surveys; bibliographic research; and synthesis of scattered information (e.g., Checklist of the Typhlopidae). Current staff research centers on the systematics, zoogeography and ecology of nearctic and neotropical reptiles and amphibians; collection-based ecological studies; monographic reviews of colubrid snakes; intergroup relationships of turtles; and the use of time-share computers in systematic research.

Birds

Research on birds has an ecological orientation, with emphasis on sea birds and land birds of the New World. Research by the Division's scientists includes distribution and ecology of sea birds and tropical American birds; systematics of North American birds; migration studies of birds in the Old World; and functional anatomy of birds. The skin collections of the Division are particularly strong for North America and parts of Central and South America, the central Pacific Ocean, and Southeast Asia. The large anatomical collections of skeletons and spirit specimens have a worldwide representation and include nearly all families and the majority of genera of birds.

Mammals

The collection of Recent mammals, numbering more than 350,000 specimens, is one of the largest in the world. It is worldwide in scope and particularly rich in type material. A majority of the specimens are preserved as skins and skulls, but the collection of skeletons and fluid-preserved specimens is unusually large and relatively complete. Facilities are especially well suited for research in systematics and gross anatomy. Research is oriented mostly toward studies of tropical faunas, which are far less known than those of temperate areas. Current research by the staff centers on mammals of the American tropics, Africa, the Middle East, and eastern Asia. Studies include definition and nomenclature of species, generic revisions, zoogeography, ecology, and epidemiology.

Two new facilities were initiated in 1967 and will provide unique opportunities for the study of marine mammals and primates. A Marine Mammal Study Center in Alexandria, Virginia, about ten minutes from the Museum, will eventually have facilities for preparation, storage, and study of the largest marine mammals. The Primate Biology Program in the Division is a multidisciplinary approach to systematics, ecological and behavioral research, and teaching.

Research Staff

JOHN W. ALDRICH, Research Staff Specialist, Division of Wildlife Research, Bureau of Sport Fisheries and Wildlife, and Research Associate, Division of Birds. 1928: Ph.B., Brown; 1933: M.A., Western Reserve; 1937: Ph.D., Western Reserve; 1937–1941: Curator of Birds, Cleveland Museum of Natural History. Specialties: systematics, distribution, and ecology of North American birds; endangered wildlife species. Fieldwork: Panama, Ohio, Mexico; current research on speciation in North American geese and cranes. Articles: "Before it is too Late" in "Birds in Our Lives," *Bur. Sport Fisheries and Wildlife* (1966); "Historical Background," "Taxonomy, Distribution and Present Status" in "The Wild Turkey and its Management," *The Wildlife Soc.* (1967); "Population Characteristics and Nomenclature of the Hermit Thrush," *Proc. USNM* (1968).

RICHARD C. BANKS, Chief, Bird Section, Bird and Mammal Laboratories, Bureau of Sport Fisheries and Wildlife, and Research Associate, Division of Birds. 1953: B.S., Ohio State; 1958: M.A., California, Berkeley; 1961: Ph.D., California, Berkeley; 1961–1962: Research Zoologist, California Academy of Sciences; 1962–1966: Curator of Birds and Mammals, San Diego Natural History Museum. Specialties: systematics, distribution, and ecology of North American birds; biology of introduced birds; current research on systematics of Argentine Tinamidae. Fieldwork: northwestern Mexico, western U.S., Hawaii. Articles: "Terrestrial Vertebrates of Anacapa Island, California," *Trans. San. Diego Soc. Nat. Hist.* (1966); "Birds and Mammals of La Laguna, Baja California," *Trans. San Diego Soc. Nat. Hist.* (1967); "The *Peromyscus guardia-interparietalis* Complex," *Journ. Mammalogy* (1967); "Relationships of the avifauna of San Esteban Island, Sonora," *Condor* (1969).

DANIEL M. COHEN, Director, Systematics Laboratory, Bureau of Commercial Fisheries, and Research Associate, Division of Fishes. 1952: B.A., Stanford; 1953: M.A., Stanford; 1958: Ph.D., Stanford; 1958–1959: Assistant Professor of Biological Sciences and Curator of Fishes, Florida State Museum, University of Florida. Specialties: ichthyology, particularly deep-sea and continental shelf and slope fishes, argentinoid, gadoid, and ophidioid fishes. Fieldwork: North Atlantic, North Pacific, Indo-Pacific. Articles: "Suborder Argentinoidea" in *Fishes of the Western North Atlantic* (1964); "A Review of the Ophidioid Fish Genus *Oligopus* with the Description of a New Species from West Africa," *Proc. USNM* (1964); with G. W. Mead, E. Bertelsen, "Reproduction Among Deep-Sea Fishes," *Deep-Sea Research,* (1964); "A New Tribe and a New Species of Ophidioid Fish," *Proc. Biol. Soc. Washington* (1966 ; with S. Atsaides, "Addition to a Revision of Argentine Fishes," *Bul. U.S. Bur. Fisheries* (1969). Speaks French.

BRUCE B. COLLETTE, Assistant Director, Systematics Laboratory, Bureau of Commercial Fisheries, and Research Associate, Division of Fishes. Visiting Professor, Marine Science Institute, Northwestern University. 1956: B.S., Cornell; 1960: Ph.D., Cornell. Specialties: structure and significance of breed tubercles in fishes; systematics and evolution of North American freshwater and epipelagic marine fishes. Current research on systematics and evolution of darters, halfbeaks, needlefishes, and tunas. Fieldwork: eastern North America, Cuba, western North Atlantic, Gulf of Guinea, southeastern Pacific; Articles: "Correlations between Ecology and Morphology in Anoline Lizards from Havana, Cuba, and Southern Florida," *Bul. Mus. Comp. Zool.* (1961); "*Hemiramphus bermudensis,* a New Halfbeak from Bermuda with a Survey of Endemism in Bermudian Shoes Fishes," *Bul. Mar. Sci. Gulf and Carib.* (1962); "The Subfamilies, Tribes and Genera of the Percidae (Teleostei)," *Copeia* (1963); Systematic Significance of Breeding Tubercles in Fishes of the Family Percidae," *Proc. USNM* (1965); "*Belonion,* a New Genus of Fresh-Water Needlefishes from South America," *Am. Mus. Novitates* (1966); with L. W. Knapp, "Catalog of Type Specimens of the Darters (Pisces, Percidae, Etheostomatini)," *Proc. USNM* (1967); with R. H. Gibbs, Jr., "Comparative Anatomy and Systematics of the Tunas, Genus *Thunnus,*" *U.S. Fish Wildl. Svc. Fish Bul.* (1967); "The Swamp Darters of the subgenus *Hololepis*; (Pisces, Percidae)," *Tulane Studies Zool.* (1962); with J. A. Peters, "The Role of Time-share computing in Museum Research," *Curator* (1968). Speaks Spanish, French. Not in residence 1970–1971.

ROBERT H. GIBBS, Jr., Curator, Division of Fishes; Doctoral Committee Member, George Washington University and Boston University. 1951: B.A., Cornell; 1955: Ph.D., Cornell; 1956–1958: Research Associate in Marine Biology, Woods Hole Oceanographic Institution; 1958–1963: Assistant and Associate Professor, Boston University. Specialty: systematics and zoogeography of the bathypelagic and epipelagic marine fishes; systematics of flying fishes. Current research on worldwide systematics and zoogeography of stomiatoids, with special reference to oceanographic correlations; classification of scombroid fishes. Fieldwork: western North Atlantic, western Indian Ocean, southeastern Pacific. Articles: with Stanley H. Weitzman, "*Cryptostomias psychrolutes,* a New Genus and Species of Astronesthid Fish from the Southwestern Pacific Ocean," *Vidensk, Medd. fra. Dansk. naturh. Foren.* (1965); with William H. Kruger, "Growth Changes and Sexual Dimorphism in the Stomiatoid Fish *Echiostoma barbatum,*" *Copeia* (1966); with Norman J. Wilimovsky, "Family Alepisauridae" in *Fishes of the Western North Atlantic* (1966); with B. B. Collette, "Comparative Anatomy and Systematics of the Tunas, Genus *Thunnus,*" *Fishery Bull.* (1967); with Barbara A. Harwitz, "Systematics and Zoogeography of the Stomiatoid Fishes, *Chauliodys pammelas* and *C. sloani,* of the Indian Ocean," *Copeia* (1967); with Michael A. Barnett, "Validity of the Stomiatoid Fish Species *Bathotphilus flemingi* and *B. indicus,*" *Copeia* (1968); "*Photonectes munificus,* a New Species of Melanostomiatid Fish from the South Pacific Subtropical Convergence, with Remarks on the Convergence Fauna," *Los Angeles County Museums Contributions in Science* (1968); with Michael A. Barnett, "Four New Stomiatoid Fishes of the Genus *Bathophilus,* with a Revised Key to the Species of *Bathophilus,*" *Copeia* (1968). Speaks German.

CHARLES O. HANDLEY, Jr., Curator, Division of Mammals. 1944: B.S., Virginia Polytechnical Institute; 1948: M.A., Michigan; 1955: Ph.D., Michigan; 1946–1947: Biologist, U.S. Fish and Wildlife Service. Specialty: systematics, distribution, ecology, and natural history of mammals of the Western Hemisphere. Current research on systematics, distribution, ecology, and natural history of mammals of Panama; distribution and ecology of mammalian ectoparasites, arboviruses, and their hosts in Venezuela. Book: *Checklist of the Mammals of Panama,* Field Mus. Nat. Hist. (1966). Articles: "A Review of the Genus *Hoplomys* (Thick-Spined Rat), with Description of a New Form from Isla Escudo de Veraguas, Panama," *Sm. Misc. Coll.* (1959); "A Revision of American Bats of the Genera *Euderma* and *Plecotus," Proc. USNM* (1959); "A Synopsis of the Genus *Kogia* (Pygmy Sperm Whales)" in *Whales, Dolphins, and Porpoises* (1966). Speaks French, German, Spanish.

JOHN PATRICK HUBBARD, Associate Curator in Charge of Palearctic Migrant Survey, Division of Birds. 1961: B.A., Western New Mexico; 1964: M.S., Michigan; 1967: Ph.D., Michigan; 1961–1964: Teaching Assistant in Zoology, Ornithology, and Botany, University of Michigan. Specialties: biology of southwestern North America and avian systematics; current research on migration, virology, and biology of palearctic birds. Fieldwork: U.S., Libya, Mexico, Canada, Egypt, Cyprus. Articles: "Noteworthy Records from New Mexico," *Condor* (1963); "Some Butterflies of the Pinos Altos Mountains, New Mexico," *J. Lept. Soc.* (1965); "Migration of the Black-throated Blue Warbler in Southern Michigan," *Jack-pine Warbler* (1965); "The Summer Birds of the Forests of the Mogollon Mountains, New Mexico," *Condor* (1965); "Notes on Some Chiapas Birds," *Wilson Bul.* (1967); "A Ringing Program in Egypt," *The Ring* (1967). Speaks Spanish.

ERNEST A. LACHNER, Curator, Division of Fishes; Doctoral Committee Member in Ichthyology, George Washington University. 1937: B.S., State College of Pennsylvania; 1946: Ph.D., Cornell; Doctoral Committee Member, Institute of Marine Science, University of Miami.1946–1949: Assistant and Associate Professor of Zoology, Pennsylvania State University. Specialty: systematics, evolution, zoogeography, and biology of North American freshwater fishes and tropical shore fishes; currently doing comprehensive analysis of the systematics, morphology, evolution, ecology, distribution, and dispersal of cyprinid fishes in the Appalachian Mountains, correlating physiography and geological history of the area with the distribution of all fishes. Fieldwork: Mexico; Lake Ontario; western New York, Genesee watershed; Adirondack area; England, Scotland, France; India; Ceylon; Chagos Archipelago; Burma, Andaman Islands; Philippine Islands; eastern and southeastern U.S.; northeastern and southern Piedmont westward to Texas, Ozark uplands, and Missouri River; International Indian Ocean Expedition. R/V *Anton Bruun* Cruise IVb, Indian Ocean and Arabian Sea. Special techniques: Ichthyological techniques for graduate students. Articles: "Family Apogonidae" in *Fishes of the Marshall and Marianas Islands,* USNM Bul. 202 (1953); "A Revision of the Goatfish Genus *Upeneus* with Descriptions of Two New Species," *Proc. USNM* (1954); "Populations of the Berycoid Fish Family Polymixiidae," *Proc. USNM* (1955); "Family Echeneidae" in *Fishes of the Marshall and Marianas Islands,* USNM Bul. 202 (1963).

ROXIE C. LAYBOURNE, Zoologist, Bird and Mammal Laboratories, Bureau of Sport Fisheries and Wildlife, and Research Associate, Division of Birds, 1932; A.B., Meredith College; 1944: North Carolina State; 1950: M.A., George Washington. Specialties: systematics, distribution and ecology of North American birds; specimen preparation. Fieldwork: southwestern and southeastern U.S. Articles: "Bilateral Gynandrism in the Evening Grosbeak," *Auk* (1967); with L. L. Short, "An Instance of White Wing-Baring in the Common Crow," *Wilson Bul.* (1967); with R. C. Banks, "The Red-Whiskered Bulbul in Florida," *Auk.* (1968).

RICHARD H. MANVILLE, Director, Bird and Mammal Laboratories, Bureau of Sport Fisheries and Wildlife. 1932: A.B., Dartmouth, 1935: M.A., California; 1947: Ph.D., Michigan; 1947–1955: Assistant and Associate Professor of Zoology, Michigan State University; 1955–1956: Curator of Mammals, New York Zoological Society; 1957-1959: Chief, Mammal Section, Bird and Mammal Laboratories, Fish and Wildlife Service. Specialties: systematics and distribution of North American mammals; vertebrate ecology; population dynamics; conservation. Current research on mammals of Alaska; taxonomy of *Lynx* and *Tamiasciurus;* island populations. Fieldwork: California, New England, New Mexico, Michigan, Virginia, Montana, Gaspe, Alaska. Book: *Mammals of Shenandoah National Park* (1956). Articles: "Mammals of Mount Desert Island," *Journ. Mamm.* (1942); "Small Mammal Populations in Northern Michigan," *Misc. Publ. 73, Univ. Mich. Mus. Zool.* (1949); "Small Island Community in Midsummer," *Ecology* (1951); "Outline of Zoogeography," *Mich. State Univ. Press* (1952); "Introduced Mammals and their Influence on Native Biotas," *Zoologica* (1956); with J. L. Paradiso, "Taxonomic Notes on the Tundra Vole," *Proc. Biol. Soc. Washington,* (1961); "Vertebrate Fauna of Isle au Haut, Maine," *Am. Midl. Nat.* (1964); with S. P. Young, "Distribution of Alaskan Mammals," *Bur. Sport Fisheries and Wildlife Circ. 211* (1965); "Snakes of Michigan," *Michigan Cooperative Extension Service* (1952); "Columbian Ground Squirrel in Northwestern Montana," *Journ. Mammals* (1959); "History of the Corbin Preserve," *Sm. Ann. Rpt. 1963* (1964); "The Extinct Sea Mink," *Proc. USNM* (1966); "Vertebrates of Plummers Island, Maryland," *Publ. Washington Biol. Field Club* (1968). Speaks French.

J. R. NAPIER, Curator, Division of Mammals (Primate Biology); Lecturer in Primate Biology, Queen Elizabeth College, University of London. 1943: M.R.C.S., L.R.C.P., London; 1963: D.Sc., London; 1943–1946: House-Surgeon, later Chief Assistant Orthopaedic Department, St. Bartholomew's Hospital, London; 1947–1967: Lecturer, later Reader in Anatomy, Royal Free Hospital School of Medicine, University of London. Specialties: primate locomotion, hand function, fossil man; current research on paleo-ecology of primates, analysis of locomotor function, coat color variation in squirrel monkeys. Books: with P. H. Napier, *A Handbook of Living Primates* (1967); *Origins of Man* (1968). Articles: "Prehensile Movement of the Human Hand," *Journ. Bone Jt. Surg.* (1956); with P. R. Davis, "Forelimb Bones of *Proconsul africanus," Fossill Mammals of Africa* (1959); "Prehensility and opposability in the Hands of Primates," *Symp. Zool. Soc. London,* (1961); with L. S. B. Leakey and P. V. Tobias "A New Species of the Genus *Homo* from Olduvai Gorge," *Nature* (1964); "Prospects in Primate Biology," *Proc. USNM* (1968). Not in residence academic year 1970–1971.

JOHN L. PARADISO, Zoologist, Bird and Mammal Laboratories, Bureau of Sport Fisheries and Wildlife. 1950: B.A., Johns Hopkins; also graduate work at American and Georgetown. Specialties: taxonomy and distribution of North American Canidae mammals of the eastern U.S. Current research on mammals of Florida; taxonomy and distrubution of the red wolf. Fieldwork: Florida, North Carolina, Virginia, Maryland, New Jersey, Pennsylvania. Book: edited 2nd edition of *Mammals of the World* by Ernest P. Walker (1968). Articles: "Taxonomic Notes on the Tundra Vole *(Microtus oeconomus)* in Alaska," *Proc. Biol. Soc. Washington* (1961); "Notes on Supernumerary and Missing Teeth in the Coyote," *Mammalisa* (1966); "A Review of the Wrinkle-faced Bats *(Centuria senex),"* Mammalia (1967); Mammals of Maryland," *North American Fauna* (in press); "Notes on a Recent Collection of East Texas Canids, with Comments on the Taxonomy of the Red Wolf," *American Mid. Naturalist* (1968); with A. M.

Greenhall, "Bats and Bat Banding," *Bur. Sport Fisheries and Wildlife Resource Publ.* Revising 3rd ed. *Mammals of the World,* by E. P. Walker, Johns Hopkins Press (in press). Speaks French.

RONALD H. PINE, Associate Curator in charge of the Mammal Identification Service, Division of Mammals. 1960: B.A., Kansas; 1962: M.S., Michigan; 1960: Field Collector and Leader, American Museum Model-Blagden African Expedition; 1964: Research Associate in Microbiology, University of Maryland Medical School; 1968: Ph.D., Texas Agricultural and Mechanical College. Specialty: systematics and natural history of Latin American mammals; current research on systematics and natural history of Latin American rodents and marsupials. Fieldwork: U.S., Mexico, Kenya, Canada, Venezuela, Brazil, Pakistan. Articles: with W. B. Davis, D. C. Carter, "Noteworthy Records of Mexican and Central American Bats," *Journal of Mammals* (1964); with D. C. Carter and W. B. Davis, "Notes on Middle American Bats," *S. W. Naturalist* (1966); with G. Silva, T., "Morphological and Behavioral Evidence for the Relationship between the Bat Genus *Brachyphylla* and the Phyllonycterines," *Biotropica* (in press). Speaks French, German, Spanish.

JAMES A. PETERS, Curator, Division of Reptiles and Amphibians. 1948: B.S., Michigan: 1950: M.A., Michigan; 1952: Ph.D., Michigan; 1952–1958: Instructor and Associate Professor of Biology, Brown University; 1959–1964: Associate Professor and Professor, San Fernando Valley State College. Specialties: neotropical herpetology, ecology, zoogeography; snakes of the families Colubridae, Typholopidae. Current research on neotropical herpetology, ecology, zoogeography, with emphasis on Ecuador; use of time-share computers in systematic research. Fieldwork: Asia, Africa, South America, Mexico, Ecuador. Books: *Classic Papers in Genetics* (1959); *The Snakes of the Subfamily Dipsadinae* (1960); *The Snakes of Ecuador–A Check List and Key* (1960); with D. D. Brand, *Coalcoman and Motines del Oro; An "Exdistrito" of Michoacan, Mexico* (1960); *Dictionary of Herpetology* (1964). Articles: "Liste der rezenten Amphibien und Reptilien–Colubridae (Dipsadinae)" in *Das Tierreich* (1965); "The Lizards of Ecuador–Check List and Key," *Proc. USNM* (1967). Speaks Spanish, French, German.

S. DILLON RIPLEY, Secretary, Smithsonian Institution. 1936: B.A., Yale; 1943: Ph.D., Harvard; 1961: M.A. (hon.), Yale; 1965: D.H.L. (hon), Marlboro; 1966: D.Sc. (hon.), George Washington; 1967: L.L.D. (hon.), Dickinson; 1968: L.L.D. (hon.), Hofstra; 1942: Assistant Curator of Birds, Smithsonian; 1946–1963: Associate Curator and Curator of Vertebrate Zoology, Peabody Museum, Yale University; 1946–1961: Assistant and Associate Professor of Zoology, Yale University; 1961–1964: Professor of Biology, Yale University. Faculty Titles: Research Affiliate, Ornithology, Peabody Museum, Yale; Curator, William Robertson Coe Collection Ornithology, Yale University Library. Specialty: ecological principles, especially as exemplified in birds of the Old World tropical zones; current research on *Handbook of Indian Birds* (with Salim Ali) and *Rails of the World.* Fieldwork: India, Nepal, Assam, Indonesia, Bhutan. Books: *A Synopsis of the Birds of India and Pakistan,* Bombay Nat. Hist. Soc. (1961); *A Systematic and Ecological Study of the Birds of New Guinea.,* Peabody Mus. Nat. Hist., Yale, Bul. 19 (1964); *The Sacred Grove: Essays on Museums* (1969). Articles: "The Families Prunellidae and Muscicapidae" in *Checklist of Birds of the World* (1964); "Le Martinet pale de Socotra," *L'Oiseau* (1965); with Gerd H. Heinrich, "Additions to the Avifauna of Northern Angola II," *Postilla* (1966); "A Notable Owlet from Kenya," *Ibis*

(1966); with Gorman M. Bond, "The Birds of Socotra and Abd-El-Kuri," *Sm. Misc. Coll.* (1966). Speaks French, Indonesian.

LEONARD P. SCHULTZ, Zoologist Emeritus. 1924: B.A., Albion; 1926: M.S., Michigan; 1932: Ph.D., Washington; 1964: D.Sc. (hon.), Albion; Research Associate, University of Maryland, Solomons, Maryland. 1927–1928: Assistant Professor of Zoology, Michigan State Normal College; 1928–1932: Instructor in Ichthyology, School of Fisheries, University of Washington; 1932–1936: Assistant Professor Fisheries, School of Fisheries, University of Washington. Specialty: Zoology, especially ichthyology, sea nettles and Nudibranchs of Chesapeake Bay. Fieldwork: western U.S.; Wisconsin; San Juan Islands, Washington; eastern Washington; Glacier National Park, Montana; Yellowstone National Park; Phoenix and Samoan Islands; Venezuela; Bikini and Northern Marshalls; Chesapeake Bay, and Nudibranchs of Chesapeake Bay. Books: *Review of the Parrotfishes, Family Scaridae,* USNM Bul. 214 (1958); with W. M. Chapman, E. A. Lachner, L. P. Woods, *Fishes of the Marshall and Marianas Islands,* USNM Bul. 202, vol. 2. (1960). Articles: "Revision of the Marine Silver Hatchetfishes (Family Sternoptychidae)," *Proc. USNM* (1961); with J. A. F. Garrick, "A Guide to the Kinds of Potentially Dangerous Sharks," and with Maryiln M. Malin, "Attacks by Sharks as Related to the Activities of Man," "A List of Shark Attacks for the World" in *Sharks and Survival* (1964); "The Strange World of Fishes" in *Wondrous World of Fishes,* Nat. Geog. Soc. (1965).

HENRY W. SETZER, Associate Curator, Division of Mammals; Adjunct Professor of Zoology, Oklahoma State University. 1942: B.A., Utah; 1945: M.A., Utah; 1948: Ph.D., Kansas; 1948: Assistant Curator, University of Kansas Museum of Natural History. Specialty: mammals of Africa and Southwest Asia; current research on systematics, distribution, ecology, and natural history of mammals of Africa and Southwest Asia. Fieldwork: Africa, Southwest Asia, Alaska, U.S., Costa Rica, Panama. Articles: "Subspeciation in the Kangaroo Rat *Dipodomys ordii*" (1949); "Mammals of the Anglo-Egyptian Sudan" (1956); "A Review of Libyan Mammals" (1957); "The Gerbils of Egypt" (1958); "Directions for Preserving Mammals for Museum Study" (1963). Speaks French, German, Spanish.

PAUL SLUD, Associate Curator, Division of Birds. 1958: M.S., Michigan; 1960: Ph.D., Michigan; 1961–1962: Postdoctoral Fellow, Florida State Museum; 1959–1966: Research Fellow, Research Associate, and Guggenheim Fellow, American Museum of Natural History. Specialties: ecology and distribution of Central American birds; current research on numerical comparative distribution of neotropical avifaunas. Fieldwork: Costa Rica, Honduras, Barro Colorado Island, Panama. Articles: "The Song and Dance of the Long-Tailed Manakin, *Chiroxiphia linearis,*" *The Auk* (1957); "Observations on the Nightingale Wren in Costa Rica," *The Condor* (1958); "The Birds of Finca 'La Selva,' Costa Rica: a Tropical Wet Forest Locality," *Bul. Am. Mus. Nat. Hist.* (1960); "The Birds of Costa Rica. Distribution and Ecology," *Bul. Am. Mus. Nat. Hist.* (1964); "The Birds of Cocos Island [Costa Rica]," *Bul. Am. Mus. Nat. Hist.* (1967). Speaks Spanish.

STEWART SPRINGER, Fishery Biologist (Research), Bureau of Commercial Fisheries. 1963: A. B., George Washington; 1947–1949; Assistant Production Manager, Shark Industries Division, Borden Co.; 1955–1962: Chief, Branch of Exploratory Fishing, Bureau of Commercial Fisheries. Specialties: exploratory fishing (marine); systematics ecology of sharks. Current research on systematics of deepwater sharks. Fieldwork: Gulf of Mexico and Caribbean, Mozambique Channel, California and Lower California coasts. Articles: "Notes on the Sharks of Florida," *Proc. Fla. Acad. Sci.* (1938); "Two New Atlantic Species of Dogsharks, with a Key to the Species of *Mustelus" Proc. USNM* (1939); "Three New Sharks of the Genus *Sphyrna* from the Pacific Coast of Tropical America," *Stanford Ichthy. Bul.* (1940); "Laboratory Experiments with Shark Repellants," *Proc. Gulf Caribb. Fish. Inst.* (1954); "Natural History of the Sandbar Sharks, *Eulamia milberti," U.S. Fish Wildl. Svc. Bul.* (1960); "A Review of Western Atlantic Catsharks, Scyliohinidae, with Descriptions of a New Genus and Five New Species," *U.S. Fish Wildl. Svc. Bul.* (1966); "Social Organization of Shark Populations" in *Sharks, Skates, and Rays,* Johns Hopkins Press (1967);.

VICTOR G. SPRINGER, Curator, Division of Fishes. 1948: B.A. Emory; 1954: M.S., Miami; 1957: Ph.D., Texas; 1957: Research Associate, University of Texas Institute of Marine Science; 1957–1961: Ichthyologist, Florida State Board of Conservation Marine Laboratory. Specialty: systematics, life history, and ecology of tropical marine shore fishes; current research on systematics and zoogeography of blennioid fishes. Fieldwork: Florida, Texas, Mexico, Korea, Bermuda, Bahamas, Dominica, New Zealand, Australia, Hawaii, Taiwan. Articles: with K. D. Woodburn, "Ecological Study of the Fishes of the Tampa Bay Area," *Fla. St. Bd. Cons. Mar. Lab. Prof. Papers* (1960); "Systematics and Zoogeography of Clinid Fishes of Subtribe Labrisomini," *Publ. Inst. Mar. Sci.*, U. of Texas (1959); "Revision of the Carcarhinid Shark Genera *Scoliodon, Loxodon,* and *Rhizoprionodon," Proc. USNM* (1964); with J. A. F. Garrick, "Survey of Vertebral Numbers in Sharks," *Proc. USNM* (1964); with A. J. McErlean, "Spawning Seasons and Growth of the Code Goby, *Gobiosoma robustum,* in the Tampa Bay Area," *Tul. Stud. Zool.* (1961);"Osteology and Classification of the Fishes of the Family Blenniidae," *Bul. USNM* (1968).

WILLIAM R. TAYLOR, Associate Curator, Division of Fishes. 1947: B.A., Kansas; 1951: M.S., Michigan; 1956: Ph.D., Michigan; 1954–1956: Biologist, Louisiana Wildlife and Fisheries Commission. Specialties: fishes, especially North American freshwater fishes; Indo-Pacific shore fishes and catfishes (order *Nematognathi).* Current research on systematics and zoogeography of catfishes, order *Nematognathi.* Fieldwork: eastern North America; Bay of Bengal and Andaman Sea. Articles: with Reeve M. Bailey, *"Schilbeodes hildebrandi,* a New Ameuirid Catfish from Mississippi," *Copeia* (1950); with E. A. Lachner, "A New Cardinal Fish of the Genus *Archamia* from Northern Australia," *Proc. Biol. Soc. Washington* (1960); "Fishes of Arnhem Land," *Records of the American-Australian Scientific Expedition to Arnhem Land* (1964); with Royal D. Suttkus, *Noturus munitus,* a New Species of Madtom, Family Ictaluridae, from Southern United States," *Proc. Biol. Soc. Washington* (1965); "An Enzyme Method of Cleaning and Staining Small Vertebrates," *Proc. USNM vol. 122* (1967); "A Revision of the Catfish Genus *Noturus* Rafinesque with an Analysis of Higher Groups in the Ictalnnidae," *Bul. USNNM 282* (1969).

GEORGE E. WATSON, Chairman, Department of Vertebrate Zoology. 1953: B.A., Yale; 1961: M.S., Yale; 1964: Ph.D., Yale; 1953–1954: Associate in Pathobiology, John Hopkins University; American School of Classical Studies, Athens; 1956: Columbia; 1962–1964: Assistant Curator; 1965: Associate Curator; 1966: Curator in Charge, Division of Birds, Smithsonian. Specialty: systematics and ecology of marine and

Palearctic birds; current research interests in eastern Mediterranean, Indian Ocean, Antarctic. Fieldwork: Greece and Aegean Islands; Cuba; Florida; Turkey; Chile; South Shetland Islands; Gulf of Guinea; Caribbean; western off-shore South America; Palmer Peninsula, Antarctica. Books: *Smithsonian Identification Manual: Seabirds of the Tropical Atlantic Ocean* (1966); with R. L. Zusi, R. W. Storer, *Preliminary Field Guide to the Birds of the Indian Ocean* (1963). Articles: "Three Sibling Species of *Alectoris* Partridge," *Ibis* (1962); "First Prebasic Molt in the Chukar Partridge," *Auk* (1963); with S. D. Ripley, "A New Peregrine Falcon from the Cape Verde Islands, Eastern Atlantic Ocean," *Postilla*, Yale Peabody Mus. (1963); "The Mechanism of Feather Replacement during Natural Molt," *Auk* (1963); with W. B. King, P. J. Gould, "An Application of Automatic Data Processing to the Study of Seabirds I. Numerical Coding," *Proc. USNM* (1967). Speaks modern Greek.

STANLEY H. WEITZMAN, Curator, Division of Fishes. 1951: B.A., California, Berkeley; 1953: M.A., California, Berkeley; 1960: Ph.D., Stanford; 1958–1962: Instructor in Anatomy, Stanford University School of Medicine. Specialties: anatomy and classification of fishes, systematics of South American fishes; current research on osteology and evolution of deep-sea stomiatoid fishes, osteology and evolution of South American characoid fishes; classification of Protacanthopterygii and Ostariophysi. Fieldwork: northwestern Mexico, California. Articles: with Robert H. Gibbs, Jr., "*Cryptostomias psychrolutes*, a New Genus and Species of Astronesthid Fish from the Southwestern Pacific Ocean," *Vidensk, Medd. fra. Dansk. Naturh. Foren.* (1965); with Lai Lee Chan, "Identification and Relationship of *Tanichthys albonubes* and *Aphyocypris pooni*, Two Cyprinoid Fishes from South China and Hong Kong," *Copeia* (1966); with P. H. Greenwood, D. E. Rosen, G. S. Myers, "Phyletic Studies of Teleostean Fishes with a Provisional Classification of Living Forms," *Bul. Am. Mus. Nat. Hist.* (1966); "Osteology and Relationships of South American Characid Fishes of Subfamilies Lebiasininae and Erythrininae with Special Reference to Subtribe Nannostomina" (1967); "Review of South American Characid Fishes of Subtribe Nannostoma," *Proc. USNM* (1966); "The origin of Stomiatoid Fishes with Comments on the Classification of Salmoniform fishes," *Copeia* (1967); "The Osteology and Relationships of the Astronesthidae, a Family of Oceanic Fishes," *Dana Report* (1967); Osteology and Relationships of South American Characid Fishes of Subfamilies Lebiasininae and Esythrininae," *Proc. USNM* (1969).

GEORGE R. ZUG, Assistant Curator, Department of Vertebrate Zoology. 1960: B.S., Biology, Albright University; 1963: M.S., Biology, Florida; 1968: Ph.D., Zoology, Michigan; 1968: Instructor, University of Michigan. Specialty: Systematics and functional morphology of reptiles. Fieldwork: 1957–58: Cuba; 1965: Mexico. Current research on Turtle systematics (Fossil and recent forms), color patterns in snakes, morphology of lizards. Instrumentation and special techniques: Study of locomotive behavior. Articles: "Geographic Variation–*Rhineura floridara* (Amphisbaendae: Reptila)," *Bul. Florida State Mus.* (1968); "A Fossil Mud Turtle *(Graptemys)* Pseudogeographica from Central Michigan" *Coeeia* (1966); "The Penial Morphology and the relationships of Cryptodiran Turtles" *Occasional Papers* (1966).

RICHARD L. ZUSI, Associate Curator, Division of Birds. 1951: B.A., Northwestern; 1953: M.S., Michigan; 1959: Ph.D., Michigan; 1958–1961: Instructor of Zoology, University of Maine; 1961–1963: Assistant Professor of Zoology, University of Maine. Specialty: structural adaptation and evolution of birds, with emphasis on the feeding mechanism. Fieldwork: Iceland, Dominica. United States, and Canada. Books: *Structural Adaptation of the Head and Neck in the Black Skimmer, Rynchops nigra* Linnaeus, Publ. Nuttall Ornith. Club (1962); "Fishing Rates in the Black Skimmer," *Condor* (1959); "The Function of the Depressor Mandibulae Muscle in Certain Passerine Birds," *Auk* (1959); "The Role of the Depressor Mandibulae Muscle in Kinesis of the Avian Skull," *Proc. USNM* (1967).

Other Smithsonian research scientists closely associated with the Department of Vertebrate Zoology:

Philip S. Humphrey, Principal Investigator, Pacific Ocean Biological Survey Program.

David S. Johnson, Zoologist Emeritus, systematic studies of mammals of Southeast Asia.

Alexander Wetmore, Research Associate, systematic studies of birds of Panama; paleoornithology.

ENVIRONMENTAL BIOLOGY

INTRODUCTION

In the broad research endeavors directed to environmental biological interactions, the Institution has established an interdisciplinary program of research effort. Studies of the terrestrial and marine environments with emphasis on the higher levels of animal population systems, vegetation, and whole ecosystems are formulated to analyze some of the evolving patterns of biological interchange. These efforts in ecosystem science represent a part of the Institution's objectives in studying the evolution of society in terms of planning for the future. Research contributing toward these ends is conducted in one laboratory seeking to identify mechanisms by which biological systems respond to non-ionizing radiation, and in others devoted to animal behavior, pathology, nutrition, and reproduction. In addition sanctuaries are maintained where flora and fauna can be studied in their natural state. Students are encouraged to augment their university training with study at the Smithsonian and its facilities. Such study may be directed to problems in environments ranging from the tropics to the polar regions. These studies are coordinated with a variety of kindred efforts in the United States and overseas through the medium of the International Biological Program and other similar arrangements, and reflect a capacity to provide stimulation and guidance to students of the biological environment.

As in the case of other research disciplines at the Institution, formal instruction on a group basis supplements the education programs inherent in the conduct and supervision of individual research projects and assignments. In cooperation with the D. C. Consortium of Universities, an annual seminar series in environmental biology has been conducted for the past three years and taken for academic credit by a large number of Washington area graduate students. During the forthcoming academic year a course for undergraduate students in biology is planned as is a special institute of the interactions between ecology and systematics which will be carried out at the Chesapeake Bay Center for Field Biology. This new center, administered through a consortium of the Smithsonian, the John Hopkins University, and the University of Maryland, will be purposefully devoted to higher education, conservation, and research. Additional opportunities for formal instruction are being planned for the academic year 1970–1971.

In the field of Environmental Biology, it is expected that the Office of Academic Programs will be able to offer a total of 10 Visiting Research Appointments in its programs of higher education and research training of which full stipends may be awarded to two Visiting Postdoctoral Research Associates and two Visiting Research Associates (Ph.D. Candidates).

In addition to the research staff listed below, other staff members with related interests will be found at the end of this section on Environmental Biology.

OFFICE OF ECOLOGY

I. EUGENE WALLEN, *Acting Head*

The most fundamental objective of the Smithsonian's program in ecology is to advance our understanding of the structure and functioning of ecological systems and of man's place in them. This requires that attention be given to studies at each level of biological integration, but special emphasis is placed upon investigations dealing with those higher levels that involve animal population systems, vegetation, and whole ecosystems.

Facilities

A center for ecosystem biology is being developed on the west shore of the Chesapeake Bay within easy commuting distance from scientific and educational institutions in the national capital area. The Smithsonian has formed a consortium with The Johns Hopkins University and the University of Maryland for cooperation in research and education in ecology. This is an open-ended consortium that may be joined by other universities in the Washington area. The research program, including studies of vegetation change, field and laboratory studies of social behavior of mammals, estuarine ecology, and population regulation, is under way. When fully developed, the 700-acre preserve will include both natural and controlled environments in a number of habitats and facilities for marine research.

One of the most important components of the developing ecological program is the Smithsonian Tropical Research Institute (formerly the Canal Zone Biological Area). The field facilities at Barro Colorado Island in Gatun Lake, Panama, have been operated by the Smithsonian since 1946. Increased activity in tropical research has been initiated in recognition of the significance of this region in the understanding of principles of ecology and evolutionary biology.

International Aspects

The International Biological Program (IBP) is strongly oriented toward ecosystem ecology, with a view toward broadening the productivity base for human populations. The Office of Ecology constitutes a focal point for staff participation in this program, and the ecology program is integrated wherever possible with the several sections of the IBP. The Smithsonian, in conjunction with the IBP, is concerned with the development of the international program in terrestrial conservation, one of the objectives of which is to create a world network of nature reserves. A major Smithsonian contribution to this network of reserves will be in helping with the inventories of the biological components and general descriptions of the ecosystems preserved.

Traditionally the Smithsonian has directed its attention toward the borders of knowledge and toward conducting research on an international scale. These objectives are being aided by a new ecological program of research and education in countries where the United States has an excess of foreign currencies. Some projects are already under way; others will be developed on the basis of surveys of opportunities for programs in ecosystem ecology in the foreign currency countries.

The use of these funds provides a rather unusual opportunity to combine the efforts of anthropologists and ecologists in developing a more complete history of man as a basis for understanding his current behavior in various regional ecosystems of the world, extending back into archeologically significant areas in an effort to trace man's environmental relationships.

These foreign currencies permit development of programs to study the structure and functions of natural ecosystems, with a view toward conservation and the orderly development of natural resources in countries like India, Pakistan, and Ceylon. Inventory and descriptive types of ecological investigation are required, but thorough understanding of ecosystems depends on studies of energy conversion through primary and secondary trophic levels, the dynamics of population systems, and regulatory mechanisms of the system.

The Office of Ecology has been established: (1) to contribute to theory in population biology and ecosystem science; and (2) to provide information essential to the federal government in the evolution of society in the critical years ahead.

Although the Smithsonian is developing its own broad program, strong ties with universities and governmental laboratories are expected to become a significant feature of the effort to contribute new knowledge to the field of ecosystem science.

Research Staff

I. EUGENE WALLEN, Head, Office of Oceanography and Limnology, Acting Head, Office of Ecology. 1941: B.A., Oklahoma State; 1946: M.S., Oklahoma State; 1950: Ph.D., Michigan; 1948–1956: Instructor, Associate Professor, and Chairman, Biological Science Courses, Oklahoma State University; 1957–1962: Aquatic Biologist, Atomic Energy Commission. Specialty: snail taxonomy, limnology, biological oceanography; currently working on specimen processing, undergraduate education, educational publications, program management, book reviews, Congressional statements. Fieldwork: Oklahoma, Michigan, Pakistan, Taiwan. Articles: "Some Further Records of Snail Distribution by Counties in Oklahoma," *Proc. Oklahoma Academy of Sciences* (1955); "The Toxicity to *Gambusia* of Certain Pure Chemicals in Turbid Waters," *Sewage and Industrial Wastes* (1957); "A Selected List of References on Marine and Aquatic Radiobiology," in

Radioecology (1963); "Oceanography at the Smithsonian Institution," *Nature* (1963); "Atomic and Other Wastes in the Sea," *Ocean Sciences,* U.S. Naval Inst. (1964).

HELMUT K. BUECHNER, Senior Scientist. Associate Research Professor, Johns Hopkins University; 1941: B.S., New York State University College of Forestry; 1943: M.S., Texas A. and M.; 1949: Ph.D., Oklahoma State; 1948–1965: Professor of Zoology, Washington State University. Specialty: ecology, behavior, and reproduction of large ungulates, in natural environments with emphasis on the role of social behavior in numerical homeostasis and the dynamics of ungulate populations in relationship to vegetation; current research on the territorial behavior and reproduction in the Uganda Kob (an antelope). Fieldwork: southwestern and western United States, particularly in Pacific Northwest; East Africa, primarily Uganda. Book: *The Bighorn Sheep in the United States, Its Past, Present, and Future,* Wildlife Monographs No. 4 (1960): edited with Frank B. Galley, *A Practical Guide to the Study of the Productivity of Large Herbivores* (1968). Articles: "Life History, Ecology and Range Use of the Pronghorn in Trans-Pecos Texas," *Amer. Midl. Nat* (1950); with H. C. Dawkins, "Vegetation Change Induced by Elephants and Fire in Murchison Falls National Park, Uganda," *Ecology* (1961); "Territoriality as a Behavioral Adaption to Environment in Uganda Kob," *Proc. VI Intl. Cong. of Zool.* (1963); with Robert Schloeth, "Ceremonial Mating Behavior in Uganda Kob *(Adenota Kob thomasi* Neumann)," *Tierpsychologie* (1965): with John A. Morrison, Walter Leuthold, "Reproduction in Uganda Kob with Special Reference to Behavior," *Comp. Biol. of Reproduction in Mammals* (1966); Herbicidal Control of Vegetation," *Enciclopedia Della Scienza e Della Tecnica Mondadori* (1969); with S. Dillon Ripley, "Ecosystem Science as a Point of Synthesis," *Daedalus* (1967). Speaks German, Swahili.

LEE M. TALBOT, Resident Ecologist and Smithsonian Field Representative for International Affairs in Ecology and Conservation. 1948–1949: Deep Springs College, Cal.; 1951: A.A., California, Berkeley; 1953: A.B., California, Berkeley; 1963: M.A., Ph.D., California, Berkeley; 1954–1956: Staff Ecologist, International Union for Conservation of Nature and Natural Resources (IUCN); 1959–1963 (with interruptions): Director and Principal Research Officer, East African Ecological Research Project, Foreign Field Research Program, National Academy of Sciences-National Research Council; 1964–1965: Director, Southeast Asia Project on Wildlife Resources and Parks, IUCN. Specialties: tropical savanna ecology and wildlife ecology in Africa and Asia, tropical land use ecology conservation of renewable natural resources. Fieldwork: over 70 countries of Africa (including over 5½ years in East Africa), Asia (including over 2½ years in Southeast Asia), Europe, South and North America; current research on East African savanna ecology, comparative ungulate ecology. Books: *A Look at Threatened Species–Endangered Wildlife and Other Aspects of Conservation in the Middle East and Southern Asia* (1960); with Martha H. Talbot, *The Wildebeest in Western Masailand, East Africa,* Wildlife Monographs No. 12 (1963); with Martha H. Talbot, *Renewable Natural Resources in the Philippines: Status, Problems and Recommendations,* IUCN Intl. Comm. on Natl Parks and World Wildlife Fund (1964); editor with Martha H. Talbot, *Conservation in Tropical South East Asia* (1968). Articles: "Food Preferences of Some East African Wild Ungulates," *E. Afr. Agr. and For. Journ.* (1962); "The Biological Productivity of the Tropical Savanna Ecosystem, *"The Ecology of Man in the Tropical Environment,* IUCN news series publ. No. 4 (1964); with G. Anderson, "Soil Factors Affecting Vegetation Distribution and Animal Movements on the Seregeti Plains, East

Africa," *Journ. of Ecology*, (1965). Speaks Swahili, French, Spanish, German and some Italian, Portuguese, Dutch, Indonesian-Malaysian.

FRANCIS S. L. WILLIAMSON, Director, Chesapeake Bay Center for Field Biology; Consultant on Avian Ecology, Battelle Memorial Institute. 1950: B.S., San Diego State; 1953–1955: Museum Technician, Museum of Vertebrate Zoology; 1955: M.A., California, Berkeley; 1968: D.Sc., Johns Hopkins; 1955–1964: Research Biologist, Arctic Health Research Center; 1964–1968: Associate in Pathobiology, Johns Hopkins University. Specialty: ornithology, with emphasis on distribution, reproduction, and ecology of North American birds, epizootiology of virus diseases, and helminth infections of birds; current research on Avian population studies on Amchitka Island, Alaska; Avian population studies at the Chesapeake Bay Center for Field Biology; Poxvirus disease in the starling. Articles: "The Molt and Testis Cycles of the Anna Hummingbird," *Condor* (1956); "Faunal Relationships of Birds in the Iliamna Lake Area, Alaska," Biol. Papers, Univ. Alaska (1962); "Studies on the Helmuth Fauna of Alaska, XLII, *Aploparaksis turdi* sp. n., a Hymenolepidid Cestode from Thrushes," *Journ. Parasitology* (1965); "Avifaunal Investigations," chap. 18, *Environment of the Cape Thompson Region, Alaska,* ed. Norman J. Wilimovsky, John N. Wolfe (1966); "Studies on a Pox Virus from the Starling *Sturnus vulgaris,*" Bact. Proc. *(1967).*

RADIATION BIOLOGY LABORATORY

W. H. KLEIN, *Director*

Research

All biological systems, from the unicellular through the spectrum of multicellular organisms to entire ecosystems, or for that matter the biosphere itself, can be thought of as open-ended thermodynamic systems through which energy flows. The primary source of all energy for these diverse biological systems is, of course, solar radiation. Since its inception the Radiation Biology Laboratory has directed its research efforts toward understanding the mechanisms by which radiant energy is absorbed, converted to potential chemical energy, and then utilized by cells for growth and differentiation. A large portion of the research of the Laboratory has been in both qualitatively and quantitatively determining the mechanisms by which cells rely upon relatively low intensity and low total energy stimuli to regulate and channel the flow of this potential chemical energy in metabolism, thus directing differentiation and morphogenesis.

The Laboratory was founded in 1929 as a logical extension of the Astrophysical Observatory, which from the earliest days of the Institution was interested in the effects of solar radiation upon the biosphere and developed methods for measuring solar radiation incident upon the earth. The Laboratory was originally named the Division of Radiation and Organisms; it is credited with making a number of pioneering investigations in photobiology, which include the first detailed action spectra of such diverse responses as photosynthesis, photocontrol of seed germination, the induction and reversal of photomorphogenesis in *monocots* and *dicots*, and phototropism. The specialized equipment and facilities have been developed over a long period to give it unique capabilities for undertaking fundamental, interdisciplinary studies in photobiology. In 1965 the Radiation Biology Laboratory was established as an independent bureau of the Smithsonian to continue these three major areas of research emphasis: (1) the mechanisms of photoregulatory responses to nonionizing and ionizing radiation, (2) the measurement of solar radiation incident upon the earth's surface, and (3) carbon-dating measurements.

Programs

Within this broad framework of research, current examples of specific projects are cited below to indicate the diversity and scope of the programs of the laboratory. Of course, specific studies change within the program and can include areas of research suggested by a visiting scientist's own specialty, provided that this new work is feasible within the laboratory's facilities and in general dovetails with the overall programs of the laboratory.

Morphogenesis

In the general area of photomorphogenesis, chloroplast differentiation is being studied with specific reference to protein synthesis by isolated chloroplasts which have begun to develop photosynthetic capacity after brief exposures to light. These experiments are being carried out with the hope of eventually developing techniques for the isolation of proplastids which will retain the capacity to develop photosynthetic activity and to show photomorphogenically controlled differentiation *in vitro*.

The ubiquitous plant pigment phytochrome, one of the pigment systems involved in the initial absorption of photoregulatory stimuli, is being intensively studied. Successful methods for the isolation and purification of pure phytochrome have been developed, and the chemical and physical characterization of the pigment molecule are continuing.

After the absorption of radiant energy the active pigment molecules must in some way trigger changes in the metabolic pathways of the cells which result in altered morphology and physiology. Several projects have been directed toward establishing the mechanism by which phytochrome exerts its control. Several of these currently cover alterations in the amounts and structural changes in nucleic acids and alterations in the metabolism of carbohydrates, amino acids, and high energy phosphate compounds such as ATP. Attempts are being made to demonstrate and correlate such changes in metabolism or pool sizes with known physiological and morphological responses controlled by the phytochrome system.

The potentiation and reduction of chromosome aberrations induced by X-irradiation have been reported to occur following exposure to nonionizing red and far-red radiation. Similarly, synergistic or antagonistic effects are also believed to occur for aberrations induced by ultraviolet following blue, red, or far-red exposures. A project aimed at conclusively demonstrating or explaining these effects and one examining the effect of gamma-irradiated sugars upon chromosome aberrations are in progress.

The development of photocontrol of seed germination in maturing seeds of *Arabidopsis thaliana* under controlled environmental conditions of temperature, spectral quality, and photoperiod is also being measured. Similarly *in vivo* measurements of phytochrome concentrations are being made spectrophotometrically and correlation attempted between such measurements and the physiological responses recorded by time lapse photography.

Control mechanisms of growth and tropisms are also being measured in cryptogams such as the moss *Physcomitrium* and the fungus *Phycomyces.* Spectrophotometric measurements of individual cells, action spectra or specific responses, and the optical properties of these systems are being determined in order to identify the photoreceptors involved and to gain information about the intracellular localization of the pigments.

Solar Radiation

At the same time several projects of the laboratory are devoted to measurements of the spectral quality and duration of total sun and sky radiation received upon the earth's surface as a function of latitude, season, and atmospheric weather conditions. Detectors, automatic data acquisition systems, and computerized reduction of the data have been developed. In conjunction with this project of making the basic physical measurements, a controlled greenhouse and several environmental control rooms are in operation. A general survey is in progress to determine long-term physiological responses of short-day, day neutral, and long-day plants to environments in which the day-length may be systematically increased or decreased while the total intensity of radiation during the day can be held constant or continuously varying by mimicry of natural daylight fluctuations. The intensity also may be varied uniformly during the day while constant spectral qualities of selected values are maintained in the environmental control rooms.

Carbon Dating

By utilization of the fact that all living systems are incorporating and metabolizing carbon compounds, it is possible to date the age of specimens by measuring precisely the C^{14} content. The Laboratory's carbon-dating section offers opportunities in such research techniques. The Laboratory regularly provides other researchers at the Smithsonian with carbon-dating service, handling samples of archeologic and geologic interest by carbon-14 techniques. An improved system has been developed in the Laboratory for quantitatively removing radioactive radon from samples by passing carbon dioxide through an activated charcoal trap at–40°C. This method now makes it possible to count radiocarbon samples immediately without the 30-to 40-day delay which was previously necessary. Projects concerned with dating of water samples from glacial fiords and with dendrochronology in the southwest United States are also in progress.

The research facilities of Laboratory include a number of constant-condition rooms where such environmental factors as radiant energy, temperature, and humidity are controlled, several general physiology and biochemistry laboratories, a radioisotope laboratory, and a greenhouse. A wide variety of precisely controlled sources of radiant energy and X-ray equipment, spectrophotometers, thermopiles, and photomultiplier detectors are maintained. The facilities also include a library and electronic, optical, instrument, and sheet metal and carpentry shops.

Research Staff

WILLIAM H. KLEIN, Director. 1942: B.A., Miami, Ohio; 1951: Ph.D., Purdue; 1946–1947: Instructor, Botany Department, Miami University; 1949–1951: Instructor, Purdue University; Spring, 1956: Visiting Lecturer in Biophysics, University of Maryland Graduate School. Specialties: photomorphogenesis, solar radiation, photobiology; current research on variation in the spectral quality of solar radiation and biological responses. Instrumentation and techniques: radiant and solar energy measurement techniques. Articles: with R. B. Withrow, A. P. Withrow, V. Elstad, "Time Course of Far-red Inactivation of Photomorphogenesis," *Science* (1957); "Interaction of Growth Factors with Photoprocess in Seedling Growth" in "Photoperiodism and Related Phenomena in Plants and Animals," AAAS Pub. No. 55 (1959); "Some Responses of the Bean Hypocotyl," *Am. Biol. Teacher* (1963); with L. Price, K. Mitrakos, "Light Stimulated Starch Degradation in Plastids and Leaf Morphogenesis" Proc. of Colloquium on "Le Metabolisme des pigments chlorophylliens dans la feuille," Gorsem, Belgium, 1962, *Photochem. Photobiol.* (1963); with J. L. Edwards, W. Shropshire, Jr., "Spectrophotometric Measurements of Phytochrome *in vivo* and Their Correlation with Photomorphogenic Responses of *Phaseolus*," *Plant Physiol.* (1967).

DAVID L. CORRELL, Chemist (Biochemist). 1957: B.A., North Central; 1958: M.S., Michigan State; 1961: Ph.D., Michigan State. 1961–1962: Visiting Junior Research Biochemist Scripps Institution for Oceanography, La Jolla, California. Specialties: Rhapidosomes; plant biochemistry, especially nucleic acids, phosphorus metabolism, aquatic ecology, phytochrome, sialic acids; current research on high energy phosphate compounds in algae, phytochrome in higher plants, and nucleic acids, Rhapidosomes. Fieldwork: Antarctic. Instrumentation and techniques: spectrophotometry, column chromatography, protein isolation, nucleic acid isolation. Articles: "Ribonucleic acid-Polyphosphate from algae I. Isolation and physiology," *Plant Physiol.* (1962); with others, "A phage infecting Saprospira grandis," *Can. Journal Microbiol* (1964); "Sialic acid-containing glycopeptide from Chlorella," *Science* (1964); "Ribonucleic acid-polyphosphate from algae II. Physical and Chemical properties of the isolated complexes," *Plant Physiol* (1964); with R.A. Lewin, "Rod-Shaped Ribonucleoprotein Particles from Saprospira," *Can. J. Microbiol.* (1964); Alkali-Stable RNA Fragments from *Chlorella," Phytochemistry* (1965); "Pelagic Phosphorus Metabolism in Antarctic Waters," *Limnol Oceanog.* (1965); "Ribonucleic Acid-Polyphosphate from Algae. III Hydrolysis Studies," *Plant Cell Physiol.* (1965); "Imidonitrogen in *Chlorella* 'Polyphosphate'," *Science* (1966); "Rhapidosomes'2"-O-Methylated ribonucleoproteins," *Science* (1968); "Phytochrome in etiolated annual Rye I. Changes during growth in the amount of photoreversible phytochrome in the coleoptile and primary leaf," *Planta*(1968); "Phytochrome in etiolated annual Rye I. Distribution of photoreversible phytochrome in the coleoptile and primary leaf," *Planta* (1968); "Phytochrome in etiolated annual Rye I. Isolation of photoreversible phytochrome," *Biochim. Biophys. Acta* (1968); "Phytochrome in etiolated annual Rye I. Physical and Chemical characterization of phytochrome," *Biochim. Biophys. Acta* (1968); "Multiple chromophore species in phytochrome," *Photochem Photobiol.* (1968); "Uber die Struktur des Phytochrom-Chromo-phors und seine Protein-Bindung," *Liebigs* Ann. Chem. (1969).

SIDNEY R. GALLER, Assistant Secretary for Science, Smithsonian Institution. 1944: B.S., Maryland; 1947: M.S. Maryland; 1948: Ph.D., Maryland; 1942-1943: Assistant, Agricultural Experiment Station, University of Maryland; 1944–1946: Fellow, University of Maryland; 1946–1948: Assistant Zoologist, University of Maryland; 1947: Collaborator, U.S. Fish and Wildlife Service; 1948–1950: Consultant in Human Ecology and Biophysics, and Acting Head, Biophysics Branch, Office of Naval Research; 1950–1951: Head, Ecology Section, Biology Branch, Office of Naval Research; 1951–1965: Head, Biology Branch, Office of Naval Research. Specialties: chemical, physical and biological investigations of acid ponds; polluted streams; development of microtechniques for cytological studies of marine organisms, temperature controlled test panels for ecological investigations of aquatic invertebrates, biotelemetry for migratory studies of animals, research administration. Articles: "Comments on Specifications for a Desirable Shark Repellant" in *Sharks and Survival,* ed. P. W. Gilbert (1963); "Marine Biology" in *Ocean Sciences,* ed. E.J. Long (1964); "Perspectives in Animal Telemetry" in *Biomedical Telemetry,* ed. C. A. Caceres (1965).

ELIZABETH GANTT, Biologist. 1958: B.A., Blackburn; 1960: M.S., Northwestern; 1963; Ph.D., Northwestern; 1963–1966: Dartmouth Medical School, and Research Associate in Microbiology, Dartmouth Medical School. Specialties: ultrastructure of photosynthetic apparatus, localization of accessory pigments in algae. Fieldwork: University of Minnesota Biological Station, Itasca. Articles: with H. J. Arnott, "Chloroplast Division in the Gametophyte of the Fern *Matteuccia struthiopteris* (L.) Todaro," *J.Cell Biol.*

(1963); with H. J. Arnott, "Spore Germination and Development of the Young Gametophyte of the Ostrich Fern *(Matteuccia struthiopteris)*," *Am. J. Botany* (1965); with S. F. Conti, "The Ultrastructure of *Porphyridium cruentum*," *J. Cell Biol.* (1965); with S. F. Conti, "Granules Associated with the Chloroplast Lamellae of *Porphyridium cruentum*," *J. Cell Biol.* (1966); with S. F. Conti, "Phycobiliprotein Localization in Algae," *Brookhaven Symposia in Biology* (1966). Speaks German.

TE-HSIU MA, Cytogeneticist. 1948: B.S., Catholic University of Peking; 1950: M.S., National Taiwan University; 1959: Ph.D., Virginia; 1959–1964: Assistant and Associate Professor of Biology, Emory and Henry College; 1964–1966: Assistant Professor of Biology, Western Illinois University; 1963–1967: Summer Research Participant, Biology Division, Oak Ridge National Laboratory. Specialties: red, far-red light effect on X-ray-induced chromatic breaks in *Tradescantia* pollen; effect of irradiated glucose on mitotic chromosomes of *Vicia faba;* reparation of radiation-induced chromosome breakage and exogenous nitrogenous bases of DNA and RNA; genetic control and biochemical implication of phytochrome in photoperiodism. Current research on radiation-induced chromosome aberrations and genetics of photoperiodism. Special Techniques: pollen tube culture in artificial medium, autoradiography. Fieldwork: Taiwan; China (cytotaxonomic studies of sugarcane relatives of Taiwan). Book: Illustration of *Elementary Genetics* by W. Ralph Singleton (1967). Articles: with H. W. Li, "Cytological Studies of Sugarcane and Its Relatives, IX. Further Studies of Hybrids Intergeneric and Interspecific Crosses," *Rpt. of Taiwan Expt. Station* (1951); with H.W. Ki, K. C. Shang, "Cytological Studies of Sugar-Cane and Its Relatives, X. Exclusive 'Patroclinous' Type in the F_1 of Sugarcane Variety and *Miscanthus japonicus* Anders," *Rpt. of Taiwan Expt. Station* (1953); with H.W. Li, K. S. Shang, "Cytological Studies of Sugarcane and Its Relatives, XI. Hybrid of Sugarcane and Corn," *Taiwan Sugar* (1954); with H. W. Li, S. Y. Yao, K. S. Shang, "Cytological Studies of Sugarcane and Its Relatives, XIII, F_1 *Hybrid of POJ 2725 x Narenga porphyrocoma* (Hance) Bor," *Taiwan Sugar* (1954); with H. W. Li, S. Y. Yao, K. S. Shang, "Cytological Studies of Sugarcane and Its Relatives, XIII. Desynapis and Formation of Restitutional Nucleus in EP 40–22," *Taiwan Sugar* (1955); with S. Wolff, "Far-red-Induced Mitotic Delay and the Apparent Increase of X-Ray-Induced Chromatid Aberrations in *Tradescantia* Microspores," *Radiation Botany* (1965); "Thin-layer lactose agar for pollen tube culture of *Tradescantia* to enhance planar distribution of chromosomes," *Stain Technology* (1967); "Effect of irradiated glucose solution on mitotic chromosomes of *Vicia* and *Tradescantia*," *Radiation Botany* (1968). Speaks Chinese.

MAURICE M. MARGULIES. Biochemist, 1952: B.A., Brooklyn; 1953: M.A., Yale; 1957: Ph.D., Yale; 1957: Research Associate, Haverford College; 1957–1959: McCollum Pratt Postdoctoral Fellow, Johns Hopkins University; 1959–1971: Smithsonian Institution; 1963–1965: Lecturer U.S. Department of Agriculture Graduate School; 1963-1965: Lecturer in Botany, George Washington University. Specialty: plant and microbial biochemistry, including chloroplast development and photosynthesis; current research on *in vitro* protein synthesis in developing chloroplasts. Instrumentation and techniques: biochemical techniques, e.g., separation of subcellular organelles, use of radioisotopes as tracers. Articles: "Effect of Chloramphenicol on Light-Dependent Synthesis of Proteins and Enzymes of Leaves and Chloroplasts of *Phaseolus vulgaris*," *Plant Physiol.* (1964); "Relationship between Red Light Mediated Glyceraldehyde-3-Phosphate Dehydrogenase Formation and Light-Dependent Development of Photosynthesis," *Plant Physiol.* (1965);

"Effect of Chloramphenicol on Formation of Chloroplast Structure and Protein during Greening of Etiolated Leaves of *Phaseolus vulgaris,*" *Plant Physiol.* (1966); "Concerning the Preparation of Chloroplasts Active in Hill and Photosynthetic Phosphorylation Activities from Leaves of *Phaseolus vulgaris,*" *Plant Physiol.* (1966); "Effect of Chloramphenicol on Chlorophyll Synthesis of Bean Leaves," *Plant Physiol.* (1967); "*In vitro* Protein Synthesis by Plastids of *Phaseolus vulgaris.* I. Localization of Activity in the Chloroplasts of a Chloroplast Containing Fraction from Developing Leaves," *Plant Physiol.* (1967); "*In vitro* Protein Synthesis by Plastids of *Phaseolus vulgaris.* II. The Probable Relation between Ribonuclease Insensitive Amino Acid Incorporation and the Presence of Intact Chloroplasts," *Plant Physiol.* (1968); "*In vitro* Protein Synthesis by Plastids of *Phaseolus vulgaris.* III. Formation of Lamellar and Soluble Chloroplast Protein," *Plant Physiol.* (1968). Not in Residence 1970–1971.

WALTER SHROPSHIRE, Jr., Physicist (Biophysics) and Assistant Director; Associate Professorial Lecturer in Botany, George Washington University. 1952: A.A., George Washington; 1954: B.S., George Washington; 1956: M.S., George Washington; 1958: Ph.D., George Washington; 1954-1957: Plant Physiologist, Smithsonian Astrophysical Observatory; 1957–1959: Research Fellow in Biophysics, California Institute of Technology. Specialty: photomorphogenesis (plant biophysics, phototropism, photobiology, cell physiology); current research on measurement of and effects produced by radiant energy on biological systems and the characterization of plant photoreceptors. Articles: "The Lens Effect of Phototropism of *Phycomyces,*" *J. Gen. Physiol.* (1962); "Photoresponses of the Fungus, *Phycomyces,*" *Physiol. Reviews* (1963); with W. M. Dugger, Jr., O. C. Taylor, W. H. Klein, "Action Spectrum of Peroxyacetyl Nitrate Damage to Bean Plant," *Nature* (1963); with Rebecca H. Gettens, "Light Induced Concentration Changes of Adenosine-Triphosphate in *Phycomyces* sporangiophores," *Plant Physiol.* (1966); with W. H. Klein, J. L. Edwards, "Spectrophotometric Measurements of Phytochrome *in vivo* and Their Correlation with Photomorphogenic Responses of *Phaseolus,*" *Plant Physiol.* (1967). On leave 1 September, 1968–1 September, 1969: Botanisches Institut der Universität Freiburg in Breisgau, Germany.

ROBERT STUCKENRATH, JR., Anthropologist. 1952: B.A. Allegheny; 1955: LL.B., Pennsylvania; 1963: M.S. Pennsylvania; 1969: Ph.D., Carbon Laboratory, University of Pennsylvania; 1966–1968: Research Specialist, Radiocarbon Laboratory, University of Pennsylvania. Specialties: radiocarbon dating and archeology of early occupations of New World. Current research on development of process for rapid and efficient combustion and purification of radiocarbon samples, on the relation of environmental changes to cultural development by analysis of early occupations of northeastern North American in light of Late and Post-Pleistocene glacial, oceanographic, and palynological data. Fieldwork: Nova Scotia, Arctic Alaska, Pennsylvania. Articles: with E.K. Ralph "Carbon-14 Measurements of Known Age Samples," *Nature* (1960); with E.K. Ralph, "University of Pennsylvania Radiocarbon Dates V," *Radiocarbon* (1962); "University of Pennsylvania Radiocarbon Dates VI," Radiocarbon (1963); "The Debert Site: Early Man in the Northeast," *Expedition* (1964); with W.R. Coe, "A Review of La Venta, Tabasco, and its Relevance of the Olmec Problem," *Kroeber Anthropology Society Papers* (1964); with E. K. Ralph "University of Pennsylvania Radiocarbon Dates VIII," *Radiocarbon* (1965); "On the Care and Feeding of Radiocarbon Dates," *Archaeology* (1965);

"Carbon-14 and the Unwary Archaeologist," *Proceedings of the Sixth International Carbon-14 and Tritium Dating Conference* (1966); with E. K. Ralph and W. R. Coe, "University of Pennsylvania Radiocarbon Dates IX," *Radiocarbon* (1966); "University of Pennsylvania Radiocarbon Dates X," *Radiocarbon* (1967); "The Debert Site: Radiocarbon Dating," *Quaternaria* (1967); with Barbara Lawn "University of Pennsylvania Radiocarbon Dates XI," *Radiocarbon* (1969).

ROBERT L. WEINTRAUB, Plant Physiologist; Professor of Botany, George Washington University. 1931: B.S., George Washington; 1933: M.A., George Washington; 1938: Ph.D., George Washington; 1959–1963: Physical Science Administrator, U.S. Army. Specialty: physiology and biochemistry of plants and micro-organisms; current research on morphogenic and biochemical effects of light on plants. Articles: with E. D. McAlister, "Developmental Physiology of the Grass Seedling. I. Inhibition of the Mesocotyl of *Avena sativa* by Continuous Exposure to Light of Low Intensities," *Sm. Misc. Coll.* (1942); "The Influence of Light and Carbon Dioxide in the Respiration of Etiolated Barley Seedlings," *Sm. Misc. Coll.* (1944); with L. Price, "Development Physiology of the Grass Seedling. II. Inhibition of Mesocotyl Elongation in Various Grasses by Red and Violet Light," *Sm. Misc. Coll.* (1947); "Plant Growth Regulators," *Economic Botany* (1949); "Structure Activity Relationships in Plant Growth-Regulators," *National Research Council Publ.* (1950); with Richard C. French, "Perlargonaldehyde as an Endogenous Germination Stimulator of Wheat Rust Spores," *Archiv. Biochem. Biophys.* (1957).

NATIONAL ZOOLOGICAL PARK

THEODORE H. REED, *Director*

The National Zoological Park, established in 1890, occupies 175 acres in Washington's Rock Creek Park and maintains a collection of over 3,000 specimens of approximately 900 species of mammals, birds, and reptiles. The Office of the Director contains an Information and Education Division. The Animal Department has six Divisions, including the Veterinary Division and the Commissary. A Scientific Research Department, headed by a resident scientist, was established in 1965. Other departments and divisions provide supporting services.

Since its founding the Zoo has been a site for research by staff members and visiting scientists. Not until 1965, however, were any staff members engaged exclusively or primarily in research. The new organization plan places the four animal Divisions under professionals skilled in husbandry. Members of the Scientific Research Department will not have administrative responsibility for the collection but will have access to it.

Facilities

In 1961 the Zoo began a twelve-year program of physical redevelopment, plans for which encompass the entire site. A new birdhouse and large outdoor flight cage were built in the first phase. New facilities for hoofed animals were completed in 1966. Planned projects include a new hospital and a scientific research center. Until 1970 facilities for staff and visiting scientists will be limited.

The research center will include facilities for housing animals under study. Among these facilities are rooms where tropical and cold climates can be maintained, mud-bottom pools, bird enclosures, and paddocks. They are removed from the public exhibition area and designed to permit flexible research designs.

Research

The Zoo's research objectives are broad, including investigations in animal behavior, ecology, nutrition, reproductive physiology, pathology, and clinical veterinary medicine. Much of the contemplated research will be conservation-oriented, seeking information helpful to the maintenance of wild populations and to long-term captive breeding and care, especially of endangered species.

Zoological parks are a rich resource of material for scientific study, both in their living collections and in their records. Relatively little of the historical data has, as yet, been systematized and analyzed. Opportunities for comparative studies of reproduction, behavior, nutrition, metabolism, and disease processes are extensive and unexploited.

The projected scientific research staff will include a biomedical research group headed by a pathologist with such specialists as a parasitologist, bacteriologist, and histologist. This group will collaborate with the Veterinary Division in diagnostic and disease prevention studies. It will also collaborate with research scientists in establishing physiological baselines and maintaining optimum conditions during experimental procedures.

The research staff will also contain investigators in such fields as mammalogy, ornithology, ecology, nutrition, reproduction, and ethology. It is anticipated that a number of scientists will be employed by the Zoo. Facilities will also be available to guest scientists and graduate students, including those whose projects are grant-supported.

The Resident Scientist is responsible for initial discussions with scientists and graduate students who wish to conduct investigations at the Zoo. He is responsible for the professional development of students and junior staff members.

The projected staff of the new center includes a scientific librarian, who will provide service to staff members and guest workers and serve as a distribution agent for information to the scientific community.

The information and education staff is headed by a zoologist. This group is responsible for open education, providing publications and answers to inquiries to the general public, visitors, and school groups. Future plans call for an education building which will house a library, lecture hall, classrooms, and facilities for audio-visual production and presentation.

Currently the Zoo's Veterinary Division is engaged in a number of research projects. One is the development of biological telemetry techniques, whereby information on body temperature, blood pressure, cardiac rate and respiration can be obtained continuously without subjecting animals to the stresses of handling and immobilization. Bioinstrumentation methods are expected to have many applications in field studies of wild populations.

Another new field of investigation is the application of closed-circuit television in zoological parks. The combination of camera and monitor permits observation of animals during times when they would be disturbed by human presence. Several tape recordings have been made of birth phenomena.

A third field, closely related to maintenance of animal collections, is the feeding and rearing of newborn animals. Investigations include studies of the factors which cause some animal mothers to reject newborns and of the hand-rearing of rejected infants.

The Veterinary Division contributes its experiences to a growing common pool of information on immunization methods and dosages of tranquilizing drugs.

A guest worker is conducting a continuing comparative study, chiefly by color photography, of the exterior of eyes of mammals, birds, and reptiles. The collection of photographs gathered over five years is unique.

On request, and when available, the Veterinary Division furnishes specific animal tissues or whole specimens to institutions engaged in biomedical research. On occasion the Zoo has advised biomedical research institutions on the selection, procurement, and care of experimental animals. However, the National Zoological Park does not contemplate traumatic or terminal experiments with animals in its care. Exceptions may be made in selected cases, such as the use of a common snake species to determine the safe drug dosage for a rare specimen.

Cooperation

An objective of the Veterinary Division is to perform autopsies on all specimens that die. Complete studies must await development of the biomedical unit. At present, by informal agreement, the Armed Forces Institute of Pathology, Walter

Reed Army Medical Center, assigns members of its staff, on a rotating basis, to participate in autopsies and conduct studies of tissues.

The National Zoo is increasingly involved in international efforts to conserve rare and endangered species. Members of the Zoo staff participate in numerous scientific and conservation groups, including the International Union for the Conservation of Nature and Natural Resources, the International Union of Directors of Zoological Gardens, the American Association of Zoological Parks and Aquariums, and the Wild Animal Propagation Trust. The Zoo is becoming a center for the collection and distribution of information on endangered species, especially those in collections. The Zoo is participating in agreements to restrict traffic in illegally procured animals and to promote inter-zoo breeding arrangements. Long-range plans include establishment of a conservation farm for propagation and research.

Research Staff

THEODORE H. REED, Director, National Zoological Park. 1945: D.V.M., Kansas State. Specialties: animal behavior and veterinary medicine. Fieldwork: Kenya; current research on growth, development, and ontogeny of behavior in *Panthera tigris.* Articles: with A. Mindon, "Where Do Visitors Come From?" *Intl. Zoo Yearbook* (1961); with L. Carmichael and M. A. Kraus, "The Washington National Zoological Park Gorilla, *Gorilla gorilla,* Infant, Tomoka," *Intl. Zoo Yearbook* (1961); "Enchantress!," *Natl. Geol. Mag.*, (1961); "Gorilla Birth at the National Zoological Park, Washington," *Der. Zool. Gart.* (1963); "The Remodeled Bird House and New Great Flight Cage at the National Zoological Park," *Intl. Zoo Yearbook* (1966).

DONALD D. BRIDGWATER, Zoologist. 1961: B.S., Bethany Nazarene College, Oklahoma; 1964: M.S., Oklahoma State University; pursuing Ph. D. at University of Oklahoma; 1962-1965: Assistant Professor, Bethany Nazarene College; 1966-1968, Scientific Curator, Oklahoma City Zoo. Specialties: mammalogy and ethology; current research on comparative ethology and captive maintenance of mammals. Fieldwork: 1963, 1964, 1965, University of Oklahoma Biological Station. Articles: with D.F. Penny, "Predation by *Citellus tridecemblineatus* on Other Vertebrates," *Journ. Mammalogy* (1966); "Laboratory Breeding, Early Growth, Development and Behavior of *Citellus tridecemblineatus* (Rodentia), " *Southwestern Naturalist* (1966); "Winter Movement and Habitat Use by Harris' Sparrow *Zonotrichia querula,*" *Proc. Oklahoma Acad. Sci.* (1966); with P. W. Ogilvie, "Notes on the Breeding of an Indian Pangolis *Manis crassicaudata* at Oklahoma Zoo," *International Zoo Yearbook* (1967).

LARRY R. COLLINS, Zoologist. 1965: B.A., Columbia Union College; 1966-67: public school teacher, Montgomery County. Specialty: predatory behavior of dasyure marsupials; current research on ethology of marsupials and rodents. Fieldwork: New Zealand and Australia, 1969.

JOHN F. EISENBERG, Resident Scientist, National Zoological Park. Research Associate Professor, Department of Zoology, University of Maryland. 1957: B.S., Washington

State; 1959; M.A., California, Berkeley; 1962: Ph.D., California, Berkeley; 1962-1964: Assistant Professor, University of British Columbia; 1964-1965: Assistant Professor, University of Maryland. Specialty: mammalian social behavior; current research on reproduction and behavior of the Asiatic elephant, reproduction and behavior of dasyurid marsupials Special technique: use of sonograph. Fieldwork: western U.S., Canada, Mexico, Panama, Madagascar, Ceylon. Articles: "The Behavior of Heteromyid Rodents," Univ. of Calif. Publ. Zool. (1963); "Studies on the Behavior of *Sorex vagrans,*" Am. Midl. Nat. (1964); with Wolfgang Pfeiffer, "Die Lauterzeugung der Dorwelse (Doradidae) und der Fiederbartwelse (Mockokidae)," *Ziet f. Morph. Oekol. des Tieres* (1956); "The Social Organizations of Mammals," *Handbuch der Zoologie VIII* (1965); with E. Gould, "The Behavior of *Solenodon paradoxus* in Captivity with comments on the Behavior of Other Insectivora," *Zoologica* (1966); with R. E. Kuehn, "The Behavior of *Ateles geoffroyi* and Related Species," Sm. Misc. Coll. (1966); with E. Gould, "Notes on the Biology of the Tenrecidae," *J. Mammalogy* (1966); "Comparative Studies of the Behavior of Rodents with Special Emphasis on the Evolution of Social Behavior, "*Proc. U.S. Nat. Mus.* (1967); with G. McKay, "An Annotated Checklist of the mammals of Ceylon, with Keys to the species," *Ceylon Journ. Sci.* (1969); "The Censussing of Animal Populations by Indirect Methods," *Ceylon Journ. Sci.* (1969).

CLINTON W. GRAY, Veterinarian, Head, Animal Health Department. 1944: D.V.M., Michigan State; 1955-1963: Veterinarian, Agency for International Development. Specialty: diseases of exotic animals; current research on biomedical telemetry, applications of closed-circuit television care of newborn exotics. Current research on immobilization techniques in exotic animals, and comparative medicine. Fieldwork: Mexico, Central and South America, Ceylon. Articles: "Paraplegia in a Male Lowland Gorilla at the National Zoological Park," *Int. Zoo Yearbook* (1965); "Use of a Walking Cast in a Third Metatarsal Fracture in the Zebra," *Int. Zoo Yearbook* (1966); with L. G. Marcus, W. G. McCarten, Thomas Sappington, "Amoebiasis in the Komodo Dragon (*Varanus komodoensis*)," *Intl. Zoo Yearbook* (1966); with Janet Davis, W. G. McCarten, "Treatment of Pseudomonas Infections in the Snake and Lizard Collection at the National Zoological Park," *Intl. Zoo Yearbook* (1966); with D. H. Wurster, "The Chromosomes of the Spotted Hyena," *Mammalian Chromosomes Newsletter* (1967); with W. H. Tullner, "Chorionic Gonadatropin Execretion During Pregnancy in a Gorilla," *Proc. Soc. Experimental Biology and Medicine,* (1968); with D. H. Wurster, K. Benirschke, "The Chromosomes of the Ardwolf," *Mammalian Chromosomes Newsletter* (1968); with B. R. Hopper, W. H. Tullner, "Urinary Estrogen Execretion During Pregnancy in a Gorilla (*Gorilla gorilla*)," *Proc. Soc. Experimental Biology and Medicine* (1968). Speaks Spanish.

JAREN G. HORSLEY, Zoologist. 1960: B.A., San Francisco State College; 1966: M.A., San Francisco State; candidate for Ph. D. at University of Oklahoma; 1965-1969: Curator of Reptiles, Oklahoma City Zoo. Specialties: ethology, herpetology and invertebrate zoology; current research in mate selection in *Chrysemys scripta,* and territorial behavior in the subfamily Eublepharinae. Special techniques: time-motion photography and analysis.

KERRY A. MULLER, Zoologist. 1961: B.A., San Diego State College; 1958-1965: supervisory position, San Diego Zoo. Specialty: ornithology related to aviculture;

current research on ecology, diets, behavior and requirements of birds under captive conditions. Fieldwork: Cold Bay, Alaska, 1967, collecting Steller's Eiders, and Chesapeake Bay, 1966, 1967, and 1968, trapping diving ducks. Articles: "Raising the Crested Wood Partridge at the National Zoological Park," *Aviculture Mag.* (1969); "Exhibiting and Propagating Ele Owls *Micrathene Whitneyi* at the National Zoological Park," (in press).

ROBERT M. SAUER, Veterinary Pathologist. 1952: V.M.D. University of Pennsylvania. Clinical Professor of Pathology, George Washington University Medical School. 1952–1954: Field Veterinarian, State of New Jersey Bureau of Animal Industry-Control and eradication of brucellosis diagnosis and control of vesicular exanthema; 1954-1955: Instructor in Pathology, School of Veterinary Medicine, University of Pennsylvania 1955-1958: Small animal practice; 1958–1960: Associate in Pathology, School of Veterinary Medicine, University of Pennsylvania 1960–1966: Assistant Professor of Pathology, School of Veterinary Medicine, University of Pennsylvania; 1961–1968: Assistant Professor, Graduate School of Arts and Sciences, University of Pennsylvania; 1966–1968: Associate Professor of Pathology, School of Veterinary Medicine, University of Pennsylvania; 1968: Pathologist, National Zoological Park, Washington, D. C. Specialty: Pathology. Current research on survey of lesions and diseases of exotic animals with special attention to potential models for human disease. Articles: "Studies on a Pox Disease of Monkeys I. Pathology," *Research Journ. American Veterinarian Medical Assoc.* (1960); with J. E. Prier "Studies on the Pox Disease of Monkeys II. Isolation of the Etiologic Agent" *Research Journ. American Veterinarian Medical Assoc.* "A Pox Disease of Monkeys,"*Annual of the New York Acad. Sci.* (1960); with H. C. Fegley, "The Roles of Infectious and Non-Infectious Diseases in Monkey Health," *Annual of the New York Acad. Sci.* (1960); with H. C. Fegley, "Mass Treatment of Monkeys with Antibacterial Substances," *Annual of the New York Acad. Sci.* (1960); with William Medway, R. S. Brodey, "Canine Bone Neoplasms," *Journ. American Veterinarian Medical Assoc.* (1963); "Inclusion Body Hepatitis in Marmosets," *Laboratory of Animal Care* (1963); with J. E. Prier, H. C. Fegley, "Zoonoses Associated with Captive Monkeys," *Laboratory of Animal Care* (1964); "Pathology of Viral Infections," in *Basic Medical Virology* (1966); with J. Geraci, William Medway, "Erysipelas in Dolphins," *American Journ. of Veterinarian Research* (1966); "Cutaneous Mucormycosis in a Squirrel (Sciurus carolinensis)" *American Journ. of Veterinarian Research* (1966); with C. F. Reid, R. S. Brodey, "Metastatic Bone Neoplasms in the Dog," *Journ. of American Veterinarian Medical Asso.* (1966)

OFFICE OF OCEANOGRAPHY AND LIMNOLOGY

I. EUGENE WALLEN, Head

The Smithsonian Institution has been engaged in studies of marine organisms since Spencer F. Baird joined its staff more than one hundred ten years ago. Its first extensive oceanographic collections came from the 1838–1842 Wilkes 'round-the-world expedition to investigate the commercial whaling industry.

The Office of Oceanography and Limnology performs a service and research function which cuts across the work of the Smithsonian's bureaus: the National Museum of Natural History; Departments of Botany, Invertebrate Zoology, Mineral Sciences, Paleobiology, and Vertebrate Zoology; the Radiation Biology Laboratory; the Smithsonian Oceanographic Sorting Center; and the Smithsonian Tropical Research Institute.

The Office of Oceanography and Limnology (1) aids Smithsonian staff members in their aquatic research, (2) maintains liaison with ocean-going vessels and scientists to collect biological materials, (3) represents the Smithsonian Institution on various committees and councils concerned with oceanography and limnology, (4) brings the Smithsonian's oceanographic plans and needs in hydrobiology to the attention of scientists and administrators elsewhere, and (5) develops and operates a sorting center for marine biological and geological materials.

In addition to doing research on the biology and geology of the oceans, staff members of the Office and several Smithsonian bureaus are encouraged to make additional collections in unique areas; report unusual natural history features, such as the presence of cancer and other abnormalities, in order that biological and physiological studies may be pursued elsewhere; develop field guides for the identification of marine specimens; develop and test basic collecting gear for use in studying marine organisms; provide and contract for identification services; provide a field collecting staff for service in unique areas; develop curating and preservation techniques and other handling advice and experience; and provide for proper storage of collections in appropriate facilities.

Because proper study of the specimens is not feasible without an active program to gather material from areas not represented in the national collections, Smithsonian scientists continue to seek collections from chartered vessels and from ships of many public and private agencies. There is an ever-broadening involvement of the Smithsonian in collections from the routine operations as a part of the world ocean survey, from research cruises and expeditions of other agencies, and from special international programs such as the International Indian Ocean Expedition, the International Cooperative Investigations of the Tropical Atlantic, the Guinean Trawling Survey, and the International Decade of Ocean Exploration. The Smithsonian is involved as closely as possible in planning expeditions. It endeavors to provide supplies and information so that collections can be maintained and that adequate environmental data are available to provide broad interpretation of the biological data resulting from the studies.

The magnitude of effort required for this involvement in the national oceanography program is evidenced by the nearly eighty U.S. oceanographic vessels that are gathering marine specimens, many of which may end up at the

Smithsonian Institution. Not only do Smithsonian scientists participate in expeditions to all oceans, but also, as the legal repository for collections made with federal funds, the Smithsonian receives collections from the Coast Guard, the National Science Foundation, the Geological Survey, the Bureau of Sports Fisheries and Wildlife, the Navy Department, the Army Coastal Engineering Research Center, the Atomic Energy Commission, the Public Health Service, the Department of State, and other agencies and universities.

The strength of the Smithsonian lies in its unique competence to gain scientific information from mixed, multiple collections of specimens. The Institution often makes a necessary and basic contribution to any program concerned with the biology and geology of the oceans by establishing the identity of the specimens collected.

Facilities

The facilities for marine research include headquarters in the Museum of Natural History, with marine collections and laboratories containing research microscopes, dissecting equipment, microtomes, special viewing devices, electron miscroscopes, an electron probe microanalyzer, X-ray equipment including diffractometers, histological equipment, freezers and freeze-drying equipment, and special processing devices and materials of great variety.

The Radiation Biology Laboratory has the latest equipment to measure the radiation impinging on the ocean's surface and to study the efficiency of transformation of physical energy to the potential energy in marine and land plants. The Smithsonian Tropical Research Institute has facilities with running seawater on both the Pacific and the Atlantic sides of the Panamanian Isthmus in the Canal Zone.

Research Staff

I. EUGENE WALLEN, Head; Acting Head, Office of Ecology. 1941: B.A., Oklahoma State; 1946; M.S., Oklahoma State; 1950: Ph.D., Michigan; 1948–1956: Instructor, Associate Professor, and Chairman, Biological Science Courses, Oklahoma State University; 1957–1962: Aquatic Biologist, Atomic Energy Commission. Specialty: snail taxonomy, limnology, biological oceanography; currently working on specimen processing, undergraduate education, educational publications, program management, book reviews, Congressional statements. Fieldwork: Oklahoma, Michigan, Pakistan, Taiwan, Iran. Articles: "Some Further Records of Snail Distribution by Counties in Oklahoma," *Proc. Oklahoma Academy of Sciences* (19[illegible]5); "The Toxicity to *Gambusia* of Certain Pure Chemicals in Turbid Waters," *Sewage and Industrial Wastes* (1957); "A Selected List of References on Marine and Aquatic Radiobiology," in *Radioecology* (1963); "Oceanography at the Smithsonian Institution." *Nature* (1963); "Atomic and Other Wastes in the Sea," *Ocean Sciences. U.S. Naval Inst.* (1964).

WILLIAM I. ARON, Deputy Head. 1952: B.S., Brooklyn; 1957: M.S., Washington; 1960: Ph.D., Washington; Graduate Committee, George Washington University; 1956–1961: Research Assistant Professor, University of Washington; 1961–1967: Head, Biological Oceanography Group, AC Electronics Defense Research Laboratories, General Motors Corp. Current research on pelagic sampling problems, melosis of hybrid fishes. Specialty: biological oceanography. Special technique: Biological oceanographic sampling procedures. Fieldwork: North Pacific. Book: with Gunnar Rollefsen and Malcolm Mcleoad, *Waterfoods–U.S. Army Medical Services* (1959). Articles: by John D. Isaacs, ed., with W.I. Aron et al., "Disposal of Low-Level Radioactive Waste into Pacific Coastal Waters," *NAS, NRC Publ. 985 (1962);* "Some Aspects of Sampling the Macroplankton," *Rapports et Proces Verbaux* (1962); "The Distribution of Animals in the Eastern North Pacific and Its Relationship to Physical and Chemical Conditions," *J. Fish. Res. Bd. Canada* (1962); "A Description of a Discrete Depth Plankton Sampler with Some Notes on the Towing Behavior of a 6-foot Isaacs-Kidd Mid-water Trawl and a One-meter Ring Net,"*Limnology and Oceanography*(1964);"Towing Characteristics of Plankton Sampling Gear," with W.I. Aron, et al., *Limnology and Oceanography*(1965);"Report on Ships of Opportunity Program, Preliminary Feasibility Study," *GM Report No. TR65–18* (1965); with W.I. Aron et al., "Improvements in the Discrete Depth Plankton Sampler System," *Limnology and Oceanography* (1966); with Jack Gehringer, "Field Techniques," *Unesco Monograph on Oceanographic Methodology. Zoo plankton Sampling II,* (1968); "A study of the Influence of Net Speed on Catch," *Limnology and Oceanography* (1969).

SMITHSONIAN OCEANOGRAPHIC SORTING CENTER

The Smithsonian Oceanographic Sorting Center, located in the Navy Yard Annex, meets the need for a facility to coordinate the collecting of natural history specimens from the ocean and to provide services insuring that the collections are processed for their intrinsic scientific values. In addition to handling research responsibilities, the Smithsonian has always provided limited service to both governmental and nongovernmental scientists by making identifications of natural-history objects. As a part of its obligation to the national oceanography program, the Smithsonian has developed an increasing capability for the accomplishment of such service by establishing the Sorting Center.

The Sorting Center receives bulk samples from governmental and private sources; separates them into appropriate taxa for identification by specialists; obtains and coordinates the station data to provide maximum environmental information with the specimens; experiments with preservation, labeling, accessioning, shipping, and storage of specimens; trains technicians for all aspects of specimen handling; and provides information and data forms helpful to oceanographic investigations by insuring that consideration be given to the maximum collection of environmental data. More than twenty million specimens have been sorted by the Center, and more than six million of these have been shipped to specialists for study.

Geological samples from the oceans are also distributed through the sorting center. The various lithologies making up a single dredge haul, for example, are identified, inventoried, and then individual specimens are shipped to appropriate specialists. In this way many specialists are able to study specimens from one sample, and the sample itself is ensured of an initial inventory before specimens are removed for detailed study.

Of special note is project support for strong involvement of the Sorting Center in the U.S. Antarctic Research Program of the National Science Foundation (NSF). With NSF support, the Center lists specimens taken from all past U.S. efforts in the Antarctic, and it sorts and maintains records of specimens now being taken from the Antarctic. In addition, the photographs of the ocean bottom taken from the NSF research vessel *Eltanin* are duplicated by the Sorting Center and distributed to scientists.

Also noteworthy are collections made available for study by the NSF through the International Indian Ocean Expedition, by the Bureau of Commercial Fisheries, and by the Intergovernmental Oceanographic Commission's International Cooperative Investigations of the Tropical Atlantic. Other collections have come to the Sorting Center from the Pacific Halibut Commission, the Inter-American Tropical Tuna Commission, the Guinean Trawling Survey, the Geological Survey, the Coast Guard, the Navy Oceanographic Office, the Coast and Geodetic Survey, the Coastal Engineering Research Center, the Laboratory of Radiation Biology of the University of Washington, the University of Michigan, the Atomic Energy Commission, and the Government of Chile.

The Sorting Center has served as a unifying influence in the systematics of marine organisms by providing specimens as well as information concerning the stages of their processing, together with information on the commitments of specialists scattered throughout the world. Visiting scientists may find working space in the Center, and specimens are regularly shipped to nearly 200 scientists around the world for research on the populations, distributions, and interrelationships of marine organisms.

Although portions of the sorted fractions have been requested by and allocated to specialists, the uncommitted groups of organisms will provide a great reservoir of research material and information for students, scientists at large, and staff members of the Smithsonian. As uncommitted organisms are sorted into groups and become available for distribution, announcement of such groups will be made by the Sorting Center in serial publications of wide distribution in biology.

Assistance at the Sorting Center for visiting investigators is available in collecting, preserving, sorting, packaging, shipping, and identifying marine specimens. Staff scientists will provide training for technicians in various aspects of processing and will give any required assistance to visiting investigators wishing to supervise the processing of their own collections.

Cooperation

The oceanography plans of the Smithsonian have been developed in continuous consultation with scientists of the United States in all fields of biological oceanography. Hence, a large portion of this program involves cooperation with many other agencies. After 1962 the Smithsonian maintained membership in the Interagency Committee on Oceanography (ICO), and is an observer in its successor organization, the National Council on Marine Resources and Engineering Development. Bilateral joint research projects have been undertaken by the Smithsonian and the U.S. Atomic Energy Commission, the Office of Naval Research, the Department of State, the Bureau of Commercial Fisheries, the National Science Foundation, the Naval Oceanographic Office, the National Aeronautics and Space Administration, the Interagency Committee on Oceanography, and the Maryland Fisheries Commission. Also, joint research projects have been undertaken by staff members with support from the Woods Hole Oceanographic Institution, the Lamont Geological Observatory, the Marine Biological Laboratory of Woods Hole, the University of Maryland, Duke University, the University of Kansas, Johns Hopkins University, the University of Michigan, the University of Minnesota, the University of Miami, the University of Southern California, Yale University, Florida State University, the University of Washington, and others.

Projects that have been supported by other agencies have been in the areas of marine systematics and ecology, the processing of specimens, the keeping of records of natural history specimens, and the publication of appropriate documents, as well as the establishment of an oceanographic exhibit in the Museum of Natural History.

Research Staff

H.A. FEHLMANN, Chief, Smithsonian Oceanographic Sorting Center. 1947: B.A., Colorado; 1950: M.A., Colorado; 1960: Ph.D., Stanford; 1947–1948: Museum Assistant, University of Colorado Museum; 1948–1950: Biology Teaching Assistant, University of Colorado; 1951–1953: Biology Teaching Assistant, Stanford University; 1954–1955: Assistant Curator, George Vanderbilt Foundation, Stanford University; 1954–1962: Biology Instructor, Menlo College; 1962–1963: Associate Ichthyologist, Stanford University. Specialties: tropical research in freshwater stream and marine ecology, with emphasis on ichthyofauna; currently working on curatorial practices and procedures. Fieldwork: Dinosaur National Monument; Pt. Barrow, Alaska; Western Caroline and Mariana Islands; Gulf of Thailand; Cruise 4B and Cruise 9, ANTON BRUUN, IIOE; GOSNOLD cruise 74, Atlantic Shelf; Cruise 16, ANTON BRUUN, SEPBOP. South Vietnam, Indian Ocean, South East Pacific, Chagos Archipelago and Aldabra. Articles: "A new Genus and Species of Arboreal Scincid Lizards from the Palau Islands," *Occ. Pap. Nat. Hist. Mus., Stanford Univ.* (1958); "The Discovery of a Freshwater Opisthobranchiate Mollusk, ACOCHLIDIUM AMBOINENSE Strubell, in the Palau Islands," *Proc. Biol. Soc. Wash.* (1960) "Role of Smithsonian Oceanographic Center in Antarctic Research", *Antarctic Journ.* (1967); "The Smithsonian Oceanographic Sorting Center," *Journ. Washington Acad. Sci.* (1968).

DAVID M. DAMKAER, Supervisor for Plankton. 1960: B.S., Washington; 1964: M.S., Washington; 1960–1962: Research Assistant in Oceanography, University of Washington; 1962: Instructor in Oceanography, University of Washington; 1962–1965: Predoctoral Associate, University of Washington; 1966–1967: Director, Mediterranean Marine Sorting Center, Tunis. Specialty: systematics and ecology of marine calanoid copepods; current research on systematics and ecology of Copepoda in the Central Arctic Basin. Fieldwork: Gulf of Alaska; Central Arctic Basin; North African coast; Caribbean. Articles: with G.A. Heron, "Five species of deep-water cyclopoid copepods from the plankton of the Gulf of Alaska," *Smithsonian Contributions to Zoology* (1969).

NEIL C. HULINGS, Supervisor for Meiofauna. 1952: William and Mary; 1953: B.S., Texas Christian; 1955: M.S., Texas Christian; 1958: Ph.D., Florida State; 1955–1958: Research Assistant and Associate, Florida State University; 1958–1966: Assistant and Associate Professor of Biology, Texas Christian University; Director, Mediterranean Marine Sorting Center, Tunis. Specialty: taxonomy and ecology of marine ostracods; current research on taxonomy of marine ostracods and techniques of mieofauna sorting. Fieldwork: Gulf Coast; Puerto Rico; Cruise 17, ANTON BRUUN, SEPBOP. Articles: with H. S. Puri, "Ecology of Shallow Water Ostracods of the West Coast of Florida" *Pub., Zoological Station, Naples* (1964); with D.E. Keith, "A Quantitative Study of Selected Nearshore Infauna between Sabine Pass and Bolivar Point, Texas," *Pub. of the Inst. of Marine Sci.* (1965); with J.H. Baker, "Recent Marine Ostracod Assemblages off Puerto Rico" *Pub. of the Inst. of Marine Sci.* (1966); "Marine Ostracoda from the Western North Atlantic Ocean off the Virginia Coast," *Chesapeake Sci.* (1966); "Marine Ostracoda from the Western North Atlantic Ocean: Laborador Sea, Gulf of St. Lawrence and off Nova Scotia," *Crustaceana* (1967); "Marine Ostracoda from the Western North Atlantic Ocean between Cape Hatteras, North Carolina and Jupiter Inlet Florida," *Bul. of Marine Sci.* (1967); "A Review of the Recent Marine Podocopid Platycopid Ostracods of the Gulf of Mexico," *Pub. of the Inst. of Marine Sci.* (1967). Speaks French, German.

LESLIE W. KNAPP, Supervisor for Vertebrates. 1952: B.S., Cornell; 1958: M.A. Missouri; 1964: Ph.D., Cornell. Specialties: systematic ichthyology, families *Percidae* and *Platycephalidae*, and distribution of Ozark fishes; current research on hybrids in the family *Percidae*, and dentitional studies in the walleye pike. Fieldwork: Ozarks; Tennessee; ANTON BRUUN Cruise 8 in the Indian Ocean. Articles: with William J. Richards, "*Percina lenticula*, a New Percid Fish, with a Redescription of the Subgenus *Hadropterus*," *Copeia* (1964); with Bruce B. Collette, "A Catalogue of the Type Specimens of the Darters *(Pisces, Percidae, Etheostomatini)*," *Proc. U.S. Nat. Mus.* (1968); with Ray Birdsong, "*Etheostoma collettei*, a new darter of the subgenus *Oligocephalus* from Louisiana and Arkansas," *Tulane Studies Zoology Botany*.

BETTY J. LANDRUM, Biologist (Fishes). 1958: B.S., Washington; 1959–1963: College of Fisheries, University of Washington; 1959–1965: Fishery Biologist, Bureau of Commercial Fisheries, Seattle Biological Laboratory. Specialties: fishery biology, racial studies; currently developing methods to utilize automatic data processing to record binomial classification of biological material, etc. Fieldwork: ELTANIN cruise 25. Book: *Distribution of North American and Kamchatkan Sockeye Salmon in the Bering Sea and North Pacific Ocean.* INFPC Bull. (1968). Article: "Bilateral Asymmetry in Paired Meristic Characters of Pacific Salmon," *Pac. Sci.* (1966) "The Antarctic Records Program, 1966-67," *Antarctic Journ. United States* (1967); "Smithsonian Oceanographic Sorting Center Provides Multiple Services to Research," *The Newsletter-National Oceanographic Data Center* (1968); "Innovations in the Antarctic Records Program," *Antarctic Journ. United States* (1968).

JOHN C. MC CAIN, Supervisory Marine Biologist. 1962: B.A., Texas Christian; 1964: M.A. William and Mary; 1967: Ph.D., George Washington University. 1965–1967: Assistant Curator, United States National Museum; 1967–1969: Research Associate, Department of Oceanography, Oregon State University. Specialty: Taxonomy, ecology, and zoogeography of Caprellidea and Pycnogonida. Fieldwork: East and Gulf Coast of United States, Bahama Islands, Deep Freeze 68–69 R/V HERO cruise 69–1. Current research on taxonomy of Antarctic Pycnogonida, Zonation of Antarctic Benthos. Articles: "The Caprellidae (Crustacea: Amphipoda) of Virginia," *Chesapeake Science* (1965); "Abyssicaprella galatheae, a new genus and species of abyssal caprellid (Amphipoda: Caprellidae)," *Galathea Reports* (1966); with T.E. Bowman, "Variation and distribution of the pelagic amphipod *Cyphocaris challengeri* in the Northeast Pacific (Gammaridea: Lysianassidae)," *Proc. USNM* (1967); "*Paracaprella barnardi*, a new species of caprellid (Crustacea: Amphipoda) from the West Coast of Panama," *Proc. Biol. Soc. Washington* (1967); with T. E. Bowman, "Distribution of the planktonic shrimp, *Lucifer*, in the Western North Atlantic," *Bul. Marine Sci.* (1967); "The Caprellidae (Crustacea; Amphipoda) of the Western North Atlantic," *Bul. USNM* (1968); with W. Scott Gray, Jr., "The taxonomic status of *Mandibulophoxus gilesi* Barnard, 1957 (Crustacea: Amphipoda)," *Proc. Biol. Soc. Washington* (1969).

ERNANI G. MENEZ, Supervisory Marine Biologist. 1954: B.S., Phillippines; 1962: M.S., Hawaii; 1953–1958: 1953–1954: Research Assistant, University of Philippines; 1954–1958: Graduate Assistant, University of the Philippines; 1958–1961: Assistant in Botany, University of Hawaii; 1953–1958: Instructor in Botany and Zoology, Southeastern College, Philippines; 1962–1964: Academic Research Assistant, University of British Columbia. Specialty: systematics and distribution of tropical marine algae; currently surveying algae found along the banks of the Potomac River, and working on marine floristics in the Philippines. Fieldwork: Philippines; Hawaii; Micronesia; Vancouver; Palmyra, North Pacific; Panama; Isla Dawson and Fuerte Blunes, S. Chile. Articles: "The Marine Algae of the Hundred Islands, Philippines," *Phil. Jour. Sci.* (1961); "The Taxonomy of *Polysiphonia* in Hawaii," *Pac. Sci.* (1964): *Tiffaniella;*" A New Genus in the Ceramiales," *Trans. Amer. Micr. Soc.* (1964). Speaks Spanish, Tagalog, Visayan.

THOMAS E. SIMKIN, Supervisor for Geology, and Research Associate, Division of Petrology, Museum of Natural History. 1955: B.S., Swarthmore; 1960: M.S., Princeton; 1965: Ph.D., Princeton; 1956–1958: Ensign, U.S. Coast and Geodetic Survey;

1964–1965: Instructor, State University of New York, Binghamton; 1965–1967: Research Associate, University of Chicago. Specialty: igneous petrology; current research on magma hydrodynamics, oceanic volcanism, calderas and petrography. Fieldwork: Alaska, Washington, Montana, Bavarian Alps, Scotland, Galapagos Islands, and Costa Rica. Articles: "Flow Differentiation in the Picritic Sills of North Skye" in *Ultramafic and Related Rocks,* ed. P.J. Wyllie (1967); with J.V. Smith, "Minor Element Variation in Olivine", *Geol. Soc. America Special Paper 101* (1967); with K.A. Howard, "1968 Collapse of Fernandina Caldera, Galapaens Islands", *American Geophysical Union* (1969). Speaks German.

ADDITIONAL SMITHSONIAN STAFF WITH INTERESTS RELATED TO ENVIRONMENTAL BIOLOGY

JOHN W. ALDRICH, Research Staff Specialist, Division of Wildlife Research, Bureau of Sport Fisheries and Wildlife, and Research Associate, Division of Birds; Specialties: systematics, distribution, and ecology of North American birds, endangered wildlife species; Full listing under "Program in Evolutionary and Systematic Biology".

F. RAYMOND FOSBERG, Special Advisor on Tropical Biology to the Director of the Museum of Natural History; Specialties: flora of the Pacific Basin Islands, taxonomy of certain groups of Rubiaceae, all aspects of coral islands, nature and distribution of tropical vegetation, nature of ecosystems, especially island ecosystems. Full listing under "Program in Evolutionary and Systematic Biology".

CHARLES O. HANDLEY, Jr., Curator of Mammals; Specialty: systematics, distribution, ecology, and natural history of mammals of the Western Hemisphere. Full listing under "Program in Evolutionary and Systematic Biology".

MEREDITH L. JONES, Curator, Division of Worms; Specialties: taxonomy and systematics of the polychaetous annelids, spacial distribution of benthic invertebrates. Full listing under "Program in Evolutionary and Systematic Biology".

ERNEST A. LACHNER, Curator, Division of Fishes; Specialty: systematics, evolution, zoogeography, and biology of North American freshwater fishes and tropical shore fishes. Full listing under "Program in Evolutionary and Systematic Biology".

RICHARD H. MANVILLE, Director, Bird and Mammal Laboratores, Bureau of Sport Fisheries and Wildlife; Specialties: systematics and distribution of North American mammals, vertebrate ecology, population dynamics, conservation. Full listing under "Program in Evolutionary and Systematic Biology".

J.R. NAPIER, Curator, Division of Mammals (Primate Biology); Specialties: primate locomotion, hand function, fossil man. Full listing under "Program in Evolutionary and Systematic Biology".

JAMES A. PETERS, Curator, Division of Reptiles and Amphibians; Specialties: neotropical herpetology, ecology, zoogeography, snakes of the families *Colubridae, Typhlopidae,* Full listing under "Program in Evolutionary and Systematic Biology".

S. DILLON RIPLEY, Secretary, Smithsonian Institution; Specialty: ecological principles, especially as exemplified in birds of the Old World tropical zones. Full listing under "Program in Evolutionary and Systematic Biology."

KLAUS RUETZLER, Associate Curator, Division of Echinoderms; Specialties: systematics and ecology of lower marine invertebrates, particularly porifera (sponges). Full listing under "Program in Evolutionary and Systematic Biology."

STANWYN G. SHETLER, Associate Curator, Division of Pahnerogams; Specialties: taxonomy and ecology of *Campanula*, flora and vegetation of the Arctic, especially Alaska, application of statistical methods to the study of variability in natural populations, history of Russian botany. Full listing under "Program in Evolutionary and Systematic Biology."

PAUL SLUD, Associate Curator, Division of Birds; Specialties: ecology and distribution of Central American birds. Full listing under "Program in Evolutionary and Systematic Biology."

GEORGE E. WATSON, Chairman, Department of Vertebrate Zoology; Specialty: systematics and ecology of marine and Palearctic birds. Full listing under "Program in Evolutionary and Systematic Biology."

EVOLUTIONARY AND BEHAVIORAL BIOLOGY, TROPICAL ZONES

INTRODUCTION

Living systems in tropical zones are particularly complex in many aspects of evolution, ecology, and behavior. Unique opportunities for studies of undisturbed tropical ecosystems are available at Barro Colorado Island, maintained continuously as a nature reserve since 1924. Important recent developments of marine facilities make possible detailed and almost simultaneous comparative studies of both the Atlantic and Pacific Oceans as well as contiguous mud flats, offshore islands, beaches, and reefs. Studies based on these facilities are coordinated by the Smithsonian Tropical Research Institute from its headquarters in the isthmus of Panama. The Institute's research staff conduct a continuing program of research on such subjects as animal communication, the ecology of coral reefs, mammalian social organization, parasitism, predator-prey relationships, the evolution of pollination mechanisms, and the effects of seasonality and climatic fluctuations on plant and animal life. During the past several years the number of students seeking admission to the Institute's programs has grown considerably and today is limited only by the available laboratory space and the heavy research and teaching schedule of the staff.

Regular research seminars are conducted by the staff and opportunities are available through cooperative arrangements with local school systems to stimulate interest in students at lower academic levels in various aspects of natural history and conservation.

In the field of Evolutionary and Behavioral Biology, Tropical Zones, it is expected that the Office of Academic Programs will be able to offer a total of 12 Visiting Research Appointments in its programs of higher education and research training, of which full stipends may be awarded to three Visiting Postdoctoral Research Associates and two Visiting Research Associates (Ph. D. candidates).

In addition to the research staff listed below, other staff members with related interests will be found at the end of this section on Evolutionary and Behavioral Biology, Tropical Zones.

SMITHSONIAN TROPICAL RESEARCH INSTITUTE

P. O. Box 2072, Balboa, Canal Zone

MARTIN H. MOYNIHAN, *Director*

The Institute conducts a program of research focusing broadly on the evolution of patterns of behavior and ecological adaptations. The tropics, as a whole, offer the richest natural laboratory for these purposes.

Members of the Institute staff are studying such subjects as animal communication, the establishment of reproductive isolation among related species, the ecology of coral reefs, species diversity in different parts of both the New and Old World tropics, social organizations among primates and other mammals, parasitism and mimicry, the development and maintenance of colonies in hymenoptera, predator-prey strategies, the evolution of specialized pollination mechanisms, seasonal and annual variations in flowering and fruiting times, and mathematical theories of evolution and community ecology.

Within the span of a few hours, field studies in Panama and Colombia can be conducted on the biota of an extraordinary array of differing terrestrial, fresh water, and marine habitats (streams, swamps, grasslands, dry scrub, cloud forests, two oceans, mud flats, mangroves, rocky shores, sandy beaches, coral reefs, offshore islands, and atolls).

Facilities

The Institute provides facilities, at five main sites, for research in biology and related fields.

It administers a nature reserve and laboratory on Barro Colorado Island, an area of approximately 3,600 acres in Gatun Lake, near the center of the isthmus of Panama. The island is covered by well-developed humid "monsoon" forest, which has been protected from serious disturbance for 47 years and contains an extremely rich lowland fauna. Hunting is prohibited (except for limited collection of scientific specimens). The laboratory includes 1,200 square feet of air-conditioned working space, a small herbarium, cages and pens for experimental animals, and constant temperature chambers. Small boats are available for work on the lake. The Barro Colorado Island facility has well regulated 60-cycle, 120-volt, single-phase and 220-volt single– and three-phase power, which permits the use of sensitive instruments.

At its mainland headquarters in Balboa are conference rooms and study halls, six laboratories and the research library, which has nearly 11,000 volumes and receives 94 periodicals, covers mammal and bird behavior and systematics thoroughly, and is among the best libraries of its kind in the American tropics. It is frequently used by members of other scientific and educational organizations in the Canal Zone and the Republic of Panama as well as by the scientists and students conducting research at the Institute itself.

In Cali, Colombia, the Institute has opened a station with living quarters and limited laboratory space to serve as a base camp for performing research in the varied habitats of West Central Colombia. Of particular note are its opportunities for high-altitude tropical studies.

The Institute also has established two marine laboratories. One is on Naos Island, on the Pacific coast of Panama, and the other is on Galeta Island, on the Atlantic coast. Both these islands are connected to the mainland by road and causeway. They are only 50 miles apart from one another. This arrangement provides unique opportunities for detailed, and almost simultaneous, comparative studies of the biotas of two oceans. Both laboratories are equipped with running salt-water systems with the Naos complex including large tanks of up to 70,000 gallons capacity.

Education

In addition to Smithsonian Fellowships, a program has been established with the Organization of American States providing support for scientists and students, especially Latin Americans who do not have access to many other sources of support. Applications should be made to the Organization of American States, 17th Street between Constitution Avenue and C Street,N.W., Washington, D. C. 20006.

Research Staff

MARTIN H. MOYNIHAN. Director, Smithsonian Tropical Research Institute. 1950: B.A., Princeton; 1953: D. Phil., Oxford; 1953–1955: Visiting Fellow, Cornell University; 1955–1957: Research Fellow, Harvard University. Specialties: comparative behavior of new world primates and passerines, evolution of interspecific relations, functional significance of different types of social signal systems, evolution of social behavior. Fieldwork: Panama, South America. Articles: "The Organization and Probable Evolution of Some Mixed Species Flocks of Neotropical Birds," Sm. *Misc. Coll.* (1962); "Hostile and Sexual Behavior Patterns of South American and Pacific Lavidae," *Behavior* (1962); "Inter-Specific Relations between Some Andean Birds," *Ibis* (1963); "Some Behavior Patterns of Platyrrhine Monkeys. I. The Night Monkey *(Aotus trivirgatus), Sm. Misc. Coll.* (1964); "Display Patterns of Tropical American 'Nine-Primaried' Songbirds. IV. The Yellow-Rumped Tanager," *Sm. Misc. Coll.* (1966), "The Evolutions of Communal Displays," *Auk* (1963); "Communication in the Titi Money," *Callicebus J. Zool.*, Lond. (1966); "Comparative Aspects of Communication in New World Primates," *Primate Ethology* (1967); "Social Mimicry: Character Convergence versus Character Displacement," *Evolution* (1968); "The 'Coerebini': a Group of Marginal Areas, Habitats, and Habits," *Amer. Nat.* (1968). Speaks Spanish, French, German.

ROBERT L. DRESSLER. Biologist; Adjunct Professor, University of Miami. 1951: B.A., Southern California; 1957: Ph.D., Harvard; 1956–1957: Botanist, Gray Herbarium, Harvard University; 1958–1963: Taxonomist, Missouri Botanical Garden. Specialty: taxonomy and evolution of New World *Orchidaceae*, especially pollination relationships. Fieldwork: Mexico, Panama, Costa Rica, Brazil, Venezuela. Articles: "The Pre-Columbian Cultivated Plants of Mexico," Botanical Museum leaflet, Harvard (1953); "The Genus Pedilanthus *(Euphorbiaceae)," Contr. Gray Herbarium* (1957); with C. H. Dodson, "Classification and Phylogeny in the *Orchidaceae," Ann. Missouri Bontanical Garden* (1960); "Notes on the Genus Govenia in Mexico *(Orchidaceae)," Brittonia* (1965); "Why Do Euglossine Bees Visit Orichids?" *Atas do Simposio sobre a Biota Amazonica,* 1967 (1968); "Observations of Orichids and Euglossine Bees in Panama and Costa Rica," *Revista de Biologia Tropical* (1968); "Pollination by Euglossine Bees," *Evolution* (1968). Speaks Spanish, Portuguese.

PETER W. GLYNN, Biologist; Associate Professor, University of Puerto Rico. 1955: B.A., South Dakota; 1960: M.A., Stanford; 1963: Ph.D., Stanford; Honorary Research Associate, Department of Marine Sciences, University of Puerto Rico, C.A.M.A.; formerly Acting Director, Institute of Marine Biology, University of Puerto Rico, Mayaguez. Specialties: temperate and tropical intertidal ecology, coral reef ecology, and systematics and ecology of sphaeromid isopods; current research on comparative study of growth rates and reproductive activities of tropical benthic intertebrates. Fieldwork: central and southern coastal California; Mexico, tropical Pacific, Gulf of Mexico, Caribbean; British Honduras; Puerto Rico, Virgin Islands; South India, Madagascar. Instrumentation and techniques: Chlorophyll analysis, nitrogen, carbon, etc. Articles: with L. R. Almodovar, J. G. Gonzalez, "Effects of Hurricane Edith on Marine Life in La Parguera, Puerto Rico," *Carib. J. Sci.* (1964); "*Musculus pygmaeus* spec. nov., a Minute Mytilid of the High Intertidal Zone at Monterey Bay, California (Mollusca: Pelecypoda)," *Veliger* (1964); "Community Composition, Structure, and Interrelationships in the Marine Intertidal *Endocladia muricata-Balanus glandula* Association in Monterey Bay, California," *Beaufortia* (1965); "Active Movements and Other Aspects of the Biology of *Astichopus* and *Leptosynapta* (Holothuroidea)," *Biol. Bul.* (1965); "Common Marine Invertebrate Animals of the Shallow Waters of Puerto Rico," *Historia Natural de Puerto Rico* (1968); "Ecological Studies on Chiton Associations in Puerto Rico with Special Reference to Sphaeromid Isopods," *Bul. Mar. Sci.* (1968); "The Common Marine Isopod Crustacea of Puerto Rico. A handbook for marine biologists," *Stud. Fauna Curacao Carib. Is.* (1968); "A New Genus and Two New Species of Sphaeromatid Isopods from the High Intertidal Zone at Naos Island, Panama," *Proc. Biol. Soc. Washington* (1968); "Mass Mortalities of Echinoids and Other Reef Flat Organisms Coincident with Midday, Low Water Exposures in Puerto Rico," *Mar. Biol.* (1968). Speaks Spanish.

EGBERT G. LEIGH, JR., Biologist. 1962: B.A., Princeton University; 1966: Ph.D., Yale University; Assistant Professor Princeton University. Specialty: Mathematical Theory of Evolution and Community Ecology. Fieldwork: Madagascar, Ivory Coast, Egypt, New Guinea, India, and Panama. Articles: "On the Relation between the Productivity, Biomass, Diversity and Stability of a Community." *Proc. Nat. Acad. Sci.* (1965); "The Ecological role of Volterra's equations," *Amer. Math. Soc. Symp. Math Biology* (1969). Speaks French, German.

A. STANLEY RAND, Biologist. 1950: B.A., De Pauw; 1961: Ph.D., Harvard; 1961–1963: Biologista, Dept. Zoologia, Sao Paulo, Brazil. Specialty: ecology and behavior of tropical reptiles and amphibians; current research on auditory communications and vocal behavior of *Anura,* and ecology and behavior of certain lizards. Fieldwork: West Indies, Ceylon, Brazil, Panama. Articles: "An Observation on *Draceana guianensis* Foraging under Water," *Herpetologica* (1964); "Ecological Distribution between Temperature and Shyness in the Lizard *Anoris Lineatopus," Ecology* (1964); "On the Frequency and Extent of Naturally Occurring Foot Injuries in *Tropidurus torquatus* (Sauria, Iguanidae)," *Pap. Avulsos,* D. Zool., Sao Paulo (1965); "Aspects of the Ecology of the Iguanid Lizard *Tropidurus torquatus* at Belem Para," *Sm. Misc. Coll.* (1966); "Relation of Size and Distance Jumped in *Bufo Marinus," Herpetologica* (1966); "The Adaptive Significance of Territoriality in Iguanid Lizards," *Symposium of Lizard Ecology* (1967); "Ecology and social organization in the Iguanid Lizard *Anolis lineatopus* (1967); "The Ecological Distribution of the Anoline Lizards Around Kingston, Jamaica," *Breviora* (1967); "Predator-Prey Interactions and the Evolution of Aspect Diversity" *Atas do Simposio sobre a Biota Amazonica* (1967); "Running Speed of the Lizard *Basiliscus basiliscus* on water," *Copeia* (1967); "Field Notes on *Anolis lineatus* in Curacao," *Studies on the Fauna of Curacao and other Caribbean Islands* (1967); "Communal Egg Laying in Anoline Lizards," *Herpetologica* (1967); "A Nesting Aggregation of Iguanas," *Copeia* (1968); Dessication Rates in Crocodile and Iguana Eggs, *Heretologica* (1968). *Speaks Spanish, Portuguesee.*

MICHAEL H. ROBINSON, Biologist. 1963: B.Sc., WAles; 1966: D. Phil., Oxford; 1953–1960: taught in U.K. secondary schools; 1965–1966: Predoctoral Intern, Smithsonian Tropical Research Institute. Specialties: behavior and predators and antipredator adaptations; current research on predatory behavior of spiders, marmosets, insectivorous birds, and anti-predator adaptations of neotropical insects. Fieldwork: United Kingdom, Ceylon, Panama, Venezuela, Columbia. Articles: "The Defensive behavior of *Pterinoxylus spinulosus* Rdtenbacher, a Winged Stick Insect from Panama," *Psyche* (1968); "The Defensive Behavior of the Stick Insect *Oncotophasma martini* (Griffin)," *Proc. Royal Entomological Soc. London* (1968); "Predatory Behavior of *Argiope argentata* (Fabricius)," *Amer. Zool.* (1969); "Defenses Against Visually Hunting Predators," *Evol. Biol. III* (1969). Speaks French.

IRA RUBINOFF, Biologist; Associate in Ichthyology, Harvard University. 1959: B.S., Queens College; 1961: M.A., Harvard: 1963: Ph.D., Harvard; 1964: postdoctoral work, Harvard; 1965: Assistant to Curator of Ichthyology, Harvard University; 1965–1967: Research Associate, Museum of Comparative Zoology, Harvard University. Specialty: evolutionary biology, especially marine shore fishes; currently evaluating the origin of reproductive isolating mechanisms in related Atlantic and Pacific shore fishes. Fieldwork: Panama, Puterto Rico, Red Sea. Current research on aspects of the biology of *Pelamis platurus,* The Eastern Pacific Sea Snake–a colonizing species. Articles: with T. H. Hamilton, R. H. Barth, G. L. Bush, "Species Abundance: Natural Regulation of Insular Variations," *Science* (1963); with T. H. Hamilton, "Isolation, Endemism, and Multiplication of Species in the Carwin Finches," *Evolution* (1963); with R. H. Barth, T. H. Hamilton, "The Environmental Control of Insular Variation in Bird Species Abundance," *Proc. Nat. Acad. Sciences* (1964); "Mixing Oceans and Species," *Natural Hist.* (1965); "Distributional and Ecological Relationships of Panamanian Shore Fishes," *Yearbook Amer. Philo. Soc.* (1965); with T. H. Hamilton, "Measurements of Isolation for Predictions of Variation in Endemism or Sympatry for the Darwin Finches in the Galapagos Islands," *Amer. Nat.* (1967); with R. W. Rubinoff, "Interoceanic colonization of a Marine Goby through the Panama Canal," *Nature* (1968); "Central American Sea-level canal: Possible Biological effects," *Science* (1968).

NEAL GRIFFITH SMITH, Biologist. 1958: B.S., St. Johns; 1961: M.S., Cornell; 1963: Ph.D., Cornell; 1959–1963: Teaching Assistant, Cornell University. Specialist: experimental work in the field on problems in evolutionary biology, particularly with birds and the evolution of counter-adaptations by their hosts; conducting experimental study of avian species diversity in neotropical grasslands. Prime research interest in evolution of specific adaptations, primarily in birds, encompassing such subjects as the nature of competitive interactions, the evolution of mimicry, social behavior, and reproductive physiology. Fieldwork: Canadian Arctic, Greenland, Panama, South America. Articles: "Adaptations to Cliff-Nesting in Some Arctic Gulls *(larus)*," *Ibis* (1966); "Evolution of Some Artic Gulls: An Experimental Study of Isolating Mechanisms," *Amer. Ornithologists Union Monograph Series No. 4.* (1966); "Capturing Sea Birds with Avertin," *Journ. Wildl. Mangmt.* (1967); "Visual Isolating Mechanisms in Gulls," *Scientific American* (1967)", "The Advantage of Being Parasitized," *Nature* (1968); "Polymorphism in Ringed Plovers," *Ibis* (1969); "Provoked Release of Mobbing–A Hunting Technique of *Micrastur* falcons," *Ibis* (1969); "Avian Predation of Coral Snakes," *Copeia* (1969); "Nesting of King Vulture and Black Hawk-Eagle in Panama," *Condor* (1969).

ADDITIONAL SMITHSONIAN STAFF WITH INTERESTS RELATED TO EVOLUTIONARY AND BEHAVIORAL BIOLOGY, TROPICAL ZONES

F. RAYMOND FOSBERG, Special Advisor on Tropical Biology to the Director of the Museum of Natural History; Specialties: flora of the Pacific Basin Islands, taxonomy of certain groups of Rubiaceae, all aspects of coral islands, nature and distribution of tropical vegetation, nature of ecosystems, especially island ecosystems; Full listing under "Program in Evolutionary and Systematic Biology."

DAVID B. LELLINGER, Associate Curator, Division of Ferns; Specialties: Taxonomy of pteridophytes, especially those of the New World tropics, taxiometrics, in particular neotypological and evolutionary methods. Full listing under "Program in Evolutionary and Systematic Biology."

FLOYD A. McCLURE, Research Associate; Specialties: propagation, utilization, documentation and taxonomy of bamboos. Full listing under "Program in Evolutionary and Systematic Biology."

PAUL SLUD, Associate Curator, Division of Birds; Specialties: ecology and distribution of Central American birds. Full listing under "Program in Evolutionary and Systematic Biology."

PHYSICAL SCIENCES

INTRODUCTION

Research at the Smithsonian in the physical sciences reflects a long tradition of pioneering investigations on the relationships between solar and geophysical phenomena. Through the highly sophisticated facilities of Smithsonian Astrophysical Observatory, which are operated jointly with Harvard University, fresh lines of astrophysical phenomena are investigated by satellite geodesy, upper atmosphere studies, gamma ray astronomy, and optical radio observation of flare stars. These studies are complemented in the Department of Mineral Sciences by the analyses of space-introduced materials on the earth's surface as X-ray microanalysis, petrology, and chemical analyses and materials which form an integral part of the Institution's continuing research in space-earth science. Other areas of study of physical properties emphasize the systematics of major mineral groups, the composition of the oceanic crust and upper mantle of the equatorial Atlantic, and equilibrium in metamorphic rocks. The Smithsonian Astrophysical Observatory supports a high level of academic activity in which undergraduate, graduate, and postdoctoral students and scholars participate.

A long recognized educational program of lectures, seminars, and staff supervision available at the Smithsonian Astrophysical Observatory, together with the staff and resources of the Department of Mineral Sciences, reflect one of the strongest areas of research and instructional activity at the Institution.

In the field of Physical Sciences it is expected that the Office of Academic Programs will be able to offer several Visiting Research Appointments in its programs of higher education and research training of which full stipends may be awarded to four Visiting Postdoctoral Research Associates and ten Visiting Research Associates (Ph.D. candidates).

In addition to the research staff listed below, other staff members with related interests will be found at the end of this section on Physical Sciences.

SMITHSONIAN ASTROPHYSICAL OBSERVATORY

60 Garden Street, Cambridge, Massachusetts 02138

FRED L. WHIPPLE, *Director*

More than 65 scientists at the Smithsonian Astrophysical Observatory (SAO) are engaged in a broad dynamic program of astrophysical research supported by data-gathering and other facilities.

Research Programs

Historically, the Observatory pioneered studies of the relationship between solar and geophysical phenomena. Today, the Observatory still maintains leadership in furthering scientific understanding of solar effects on the high atmosphere, using analysis of satellite-tracking data as the basis for its investigations.

Research at SAO, however, extends far beyond this early interest. Programs in lunar and planetary studies, optical and radio astronomy, theoretical astrophysics, meteors and comets, meteorites and cosmic dust, flight experimentation, and atomic and molecular processes are now part of SAO's diversified research activities.

In several fields, SAO is an acknowledged innovator. Since the advent of laser tracking systems in 1966, possibilities of greater accuracy have been applied to geophysical research, including studies of continental drift, polar motion, earth tides, and ocean profiles. SAO now has laser tracking systems at several of its astrophysical observing stations.

The Observatory's 34-foot optical reflector, an array of mounted octagonal mirrors that detect secondary atmospheric particles generated by gamma rays, has greatly extended gamma-ray astronomy.

SAO's early concept of a satellite-borne astronomical telescope led to the creation of the National Aeronautics and Space Administration's (NASA) Orbiting Astronomical Observatory (OAO) program. In 1968, an SAO-designed telescope-television system, called Celescope, was launched aboard the OAO-2 satellite and has since made valuable observations of celestial objects in ultraviolet light.

Work has also begun on the improvement and utilization of a hydrogen-maser clock, the most accurate timepiece yet devised, to ensure continued accuracy in all research projects and to provide a new satellite experiment to measure gravitational redshift.

SAO is truly a center of active scientific investigation within the federal establishment, often responding to the research requirements of other, more mission-oriented agencies, such as NASA. It is virtually unique in its ability to pursue pure astrophysics directly, rather than obliquely as an offshoot of an applied mission. Thus, SAO may be viewed as "the national astrophysical observatory," ensuring a healthy balance between science inside and outside the federal structure.

The scientific objectives of the Observatory are intentionally flexible so that response to new research opportunities can be prompt and supple. By design, the research program reflects the interests of the individual scientists and hence can be adjusted to recognize the specialties of new members of the scientific staff.

SAO shares quarters with the Harvard College Observatory. The two observatories aid each other in many ways and often jointly undertake research projects.

Facilities

Observational data are provided by a variety of facilities in addition to those already noted. A worldwide network of astrophysical field stations observes artificial satellites, comets, and other celestial objects. Another network of sixteen automatic stations in the midwestern United States photographs extremely bright meteors. A radar complex in Havana, Illinois, detects the ionized trails produced by meteors. And a network of approximately 150 Moonwatch stations manned by volunteers and located around the world contributes visual data.

SAO has also constructed a multipurpose observatory on Mt. Hopkins in Arizona. The complex includes a combined laser-camera system for satellite tracking, the 34-foot gamma-ray detector, and several conventional telescopes, one of 60-inch diameter. SAO also employs an 84-foot radio "dish" antenna near Cambridge, for use in joint Smithsonian-Harvard research in radio astronomy. The Observatory is one of the participants in a nonprofit corporation that hopes to establish a large radio-radar astronomy research center in the Northeast.

All these data-collecting facilities are joined together by a global communications center at the Observatory. Major support facilities include a CDC 6400 computer with extensive auxiliary equipment, numerous workshops at Cambridge, design and drafting facilities, and in-house printing and publishing facilities.

The Observatory also has special laboratories for the radioisotopic, petrologic, and mineralogic studies of meteorites, micrometeoroids, and lunar samples; and others for the spectroscopy of atoms and molecules.

Available to the staff are SAO's own library and the libraries of Harvard College Observatory and of the University. Located virtually in the center of a scientific research community of universities, government agencies, and corporate enterprises, the Observatory investigators enjoy access to a variety of facilities and counsel. They avail themselves, moreover, of opportunities to pursue academic interests (teaching as well as study) within this community.

Cooperation

SAO cooperates with many United States and foreign institutions. Under agreements with national agencies in those countries where field stations are located, research results are shared internationally. SAO has undertaken joint projects with Harvard, Massachusetts Institute of Technology, MIT Lincoln Laboratory, NASA, U. S. Air Force, Jodrell Bank Observatory, Tokyo Astronomical Observatory, CNAE of Brazil, CNIE of Argentina, Uttar Pradesh State Observatory of India, University of Padua in Italy, National Technical University in Athens, and scores of similar institutions.

As a further example of its role in the worldwide astronomical community, SAO serves as the headquarters of three international science information clearinghouses.

The Central Bureau for Astronomical Telegrams, sponsored by the International Astronomical Union, issues from Cambridge series of telegrams and postcard circulars containing information on astronomical phenomena that requires prompt worldwide dissemination, such as newly discovered or recovered comets, novae, supernovae, variable stars, and asteroids.

The Central Bureau for Satellite Geodesy of the International Union of Geodesy collects and distributes information pertaining to the geophysical uses of artificial satellites for the international scientific community.

Also stationed in Cambridge, the Center for Short-Lived Phenomena is operated by the Smithsonian Institution in Washington, D. C. The Center serves as an international clearinghouse for rapid receipt and dissemination of information on short-lived biological and geophysical events, such as ecological changes, earthquakes, volcanoes, meteorite falls, and oil spills, using a network of more than 1500 correspondents in more than 100 nations.

Publications

Researchers at the Smithsonian Astrophysical Observatory are provided with ample opportunity to publish the results of their investigations. For example, Smithsonian staff members publish more than 130 papers each year in some 30 internationally known journals. In addition, researchers are encouraged to publish their work in SAO's own series: *Research in Space Science Special Reports* and *Smithsonian Contributions to Astrophysics.* These are distributed to more than 1600 major observatories, libraries, and research organizations and individuals around the world.

Research Staff

F.L. WHIPPLE, Director; Phillips Professor of Astronomy, Harvard University. 1923–1924: Occidental; 1927: B.A., California, Los Angeles; 1931: Ph.D., California, Berkeley; 1945: M.S. (hon.), Harvard; 1958: D. Sc. (hon.), American International; 1961: D.Sc. (hon.), Temple; 1961: D. Litt. (Hon.) Northeastern: 1962: LL.D. (hon.), C.W. Post College, Long Island University; 1932–1937: Instructor, Harvard University; 1938–1945: Lecturer, Harvard University; 1945–1950: Associate Professor, Harvard University;

1949–1956: Chairman, Department of Astronomy, Harvard University; 1942–1945: Research Associate, Radio Research Laboratory, OSRD. Specialties: cosmology, lunar studies, comets, meteors and meteorites, interplanetary dust. Received Presidential Citation June 12, 1963, "for conceiving and developing an optical tracking system for the first artificial satellite and providing valuable scientific data concerning the nature of the earth and its atmosphere as well as outer space." Has directed planning and development of an astronomical telescope to be carried in an orbiting astronomical observatory to map stars in the far ultraviolet and X-ray regions of the spectrum; has developed techniques for measuring photographically the speeds and declerations of meteors and methods for computing the orbits of comets and asteroids. Proposed a theory, generally accepted today, that comets are actually "dirty snowballs," or lumps of frozen gases and space dust, as part of an extensive theory concerning the origin of Uranus, Neptune, and Pluto, as well as the hundreds of comets, in condensations from "a giant snow storm" 50 or 60 times as wide as the distance from the earth to the sun. Current research: cosmology; lunar theory; hydrogen-alpha line of geocorona; evolution of solar system; comets. Books: *Earth, Moon and Planets* (1963); *Proceedings of the Conference on Zodiacal Light and Interplanetary Medium* (1968); with D. Menzel, G. de Vaucouleurs, *Survey of the Universe* (1970). Articles: "The History of the Solar System," *Proc. Natl. Acad. Sci.* and *The Scientific Endeavor* (1964); "Chondrules: Suggestion Concerning the Origin," *Science* (1966); "Commission 15, Comets," *Trans. Intl. Astron. Union* (1967); "On Maintaining the Meteoritic Complex," *SAO Special Rept. 239* (1967); with S. E.Hamid, B. G. Marsden, "Influence of a Comet Belt Beyond Neptune on the Motions of Periodic Comets," *Astron. Journ.* (1968); "On Fundamental Scientific Advances Resulting from the Space Program," *Sym. on Bioastronautic and the Exploration of Space, San Antonio* (1968).

C. A. LUNDQUIST, Assistant Director for Science; Associate, Harvard College Observatory. 1949: B.S., South Dakota State College; 1954: Ph.D., Kansas; 1954–1956: Physicist, Technical Feasibility Study Office, Research Projects Laboratory, Redstone Arsenal; 1956–1960: Chief, Physics and Astrophysics Section, Research Projects Laboratory, Redstone Arsenal; 1960–1962: Director, Supporting Research Office, and Chief, Physics and Astrophysics Branch, Research Projects Division, Marshall Space Flight Center. Specialties: space science, geophysical effects on earth satellites, observations from earth satellites; current research on space science, satellite geophysics. Book: *The Physics and Astronomy of Space Science* (1966). Articles: "Orbital Mechanics," Part IV, *Space Sci. and Eng.* (1965); ed., with G. Veis, "Geodetic Parameters for a 1966 Smithsonian Institution Standard Earth," *SAO Special Rpt. 200* (1966); ed., with H. D. Friedman, "Scientific Horizons from Satellite Tracking" *SAO Special Rpt. 236* (1966); with L. S. Lam and G. M. Merdes, "Design of a Satellite Experiment for Atmospheric Density and Near-Free-Molecule Flow Aerodynamics," *SAO Special Rpt. 241* (1967); "Satellite Altimetery and Orbit Determination," *SAO Special Rpt. 248* (1967) with F. L. Whipple, "Tracking by the Smithsonian Astrophysical Observatory," *Phil Trans. Roy. Soc. London* (1967); "Geodesy," *AAAS Gen. Sym. on Space Applications*, Dallas (1968); "Photometry from Apollo Tracking," *XII Plenary Meeting of COSPAR, Prague,* (1969).

A. C. ALLISON, Mathematician. 1961: B. Sc., Queen's University, Belfast; 1962: diploma in numerical mathematics, Queen's; 1967: Ph.D., Glasgow; 1962–1966: Assistant Lecturer, University of Glasgow; 1966–1967: Lecturer in Numerical Analysis, University of Glasgow. Specialty: numerical solution of ordinary differential equations. Current research: theoretical spectra of molecular hydrogen. Article: with A. Dalgarno, "Band Oscillator Strengths of the Lyman System of Molecular Hydrogen," *Astrophys. Journ.* (1968).

G. F. ANDERSON, Physicist; Associate, Harvard University. 1957: B. A., Minnesota; 1961: M. S., Minnesota; 1966: Ph.D., Colorado; 1955–1960: Teaching/Research Assistant, Minnesota; 1956–1957: Physicist, Remington Rand; 1960–1964: Staff Scientist, Lockheed; 1965: Associate Professor, Tarkio College; 1966–1968: Research Fellow, Harvard University. Speciality: solar physics, plasma physics, fluid dynamics. Current research: magnetohydrodynamic models of sunspots; models for solar-flame reduction; shock-wave propagation in inhomogeneous atmospheres; radiation transfer. Book: with Donald Menzel, *The Sky Above Us* (1969). Articles: with M. W. Rosenberg and M. M. Klein, "Microwave Scattering from Spherical Electron Clouds," NATO-AGARD *Sym. Proc.37 on Scatter Propagation of Radio Waves* (1968); "Sunspots and Magnetohydrodynamic Flows," *IAU Sym. 35 on the Structure and Development of Solar Active Regions* (1968).

E. H. AVRETT, Physicist; Lecturer in Astronomy, Harvard University. 1957: B.S., Georgia Institute of Technology; 1962: Ph.D., Harvard; 1957–1961: Teaching Fellow in Applied Mathematics, Harvard University; 1958–1961: Faculty of Arts and Sciences Fellow, Harvard University; 1961–1962: Teaching Fellow in Astronomy, Harvard University; 1962–1964: Research Associate in Astronomy, Harvard University. Specialty: stellar atmospheres (theoretical and numerical models of stellar atmospheres); currently calculating strong absorption and emission lines formed in the outermost layers of stellar atmospheres (theoretical and numerical models of stellar atmospheres); currently calculating strong absorption and emission lines formed in the outermost layers of stellar atmospheres, and collaborating in making a detailed analysis of the solar H and K lines of ionized calcium and magnesium, and in continuing investigations of the influence of departures from local thermodynamic equilibrium on the structure of model atmospheres. Articles: with D. G. Hummer, "Non-Coherent Scattering II: Line Formation with Frequency Independent Source Function," *Monthly Notices Roy. Astron. Soc.* (1965); "Solutions of theTwo-Level Line Transfer Problem with Complete Redistribution," *SAO special Rpt. 174* (1965); "Source Function Equality in Multiplets," *Astrophys. Journ.* (1966); with W. Kalkofen, "Transfer of Line Radiation by Multilevel Atoms," *Journ. Quant. Spectrosc. Radiat. Transfer* (1968).

E. E. BECKLIN, Astronomer. 1963: B.S., Minnesota; 1968: Ph.D., California Institute of Technology; 1968–1969: Post-doctoral Research Fellow, California Institute of Technology. Speciality: infrared astronomy. Current research: infrared photometry of low-temperature objects; infrared radiation from the nucleus of the Galaxy; infrared photometry of extragalactic sources. Articles: with J. A. Westphal, "Infrared Observations of Comet 1965f," *Astrophys. Journ.* (1966); with G. Neugebauer, "Observations of an Infrared Star in the Orion Nebula," *Astrophys. Journ.* (1967); with G. Neugebauer, "Infrared Observations of the Galactic Center," *Astrophys. Journ.* (1968); with G. Neugebauer, J. B. Oke, G. Garmire, "A Study of Visual and Infrared Observations of Sco XR–1," *Astrophys. Journ.* (1969).

N. P. CARLETON, Physicist; Lecturer in Applied Physics and Associate, Harvard University.

1951: B.A., Harvard; 1952: M.A., Harvard; 1956: Ph.D., Harvard; 1956–1962: Instructor and Assistant Professor, Harvard University; 1960–1962: Research Associate, NBS. Specialties: atomic physics, upper atmospheric physics, investigations of processes of astrophysical interest in atmospheres of planets, geophysics; currently directing laboratory studies of electron impact excitation of metastable levels in atoms and molecules of atmospheric interest, studies of chemical reaction of certain of these metastable atoms and molecules, and observing planetary spectra. Current research: planetary spectroscopy; astrophysical instrumentation. Articles: with F. J. LeBlanc, O. Oldenberg, "Transition Probabilities of Forbidden Oxygen Lines in a Discharge Tube," *Journ. Chem. Phys.* (1966); "Energy Transfer to and through Ionospheric Electrons," *Proc. of the Summer Inst. on Phys. of the Magnetosphere* (1967): with C. Papaliolios, P. Horowitz, W. Liller, "Optical Search for Pulsations from Pulsating Radio Source CP 1919," *Science* (1968); with A. Sharma, R. M. Goody, W. L. Liller, F. L. Roesler, "Measurement of the Abundance of CO_2 in the Martian Atmosphere, " *Astrophys. Journ.* (1969).

G. COLOMBO, Celestial Mechanician; Full Professor of Theoretical and Applied Mechanics, University of Padua, and Associate, Harvard University. 1943: B.S., Pisa; 1954: Ph.D., Padua. Specialty: investigations of concentrations and scattering properties of small particles in the solar system. Collaborated in presenting data to substantiate earlier radar observations that the planet Mercury has a rotation period of 58.65 days rather than the previously supposed 88 days. Articles: "Rotation Period of the Planet Mercury," *Nature* (1965); "Cassini's Second and Third Laws," *Astron. Journ.* (1966); with E. Bellomo, I.I. Shapiro, "Theory of the Axial Rotations of Mercury and Venus," *Act of the Sym. on the Mantles of the Earth and Terr. Pl.* (1966); with I.I. Shapiro, "The Rotation of the Planet Mercury," *Astrophys. Journ.* (1966); with I.I. Shapiro, D. A. Lautman, "The Earth's Dust Belt: Fact or Fiction?" (Papers 1–4), *Journ. Geophys. Res.* (1966). On leave.

A. DALGARNO, Physicist; Professor of Astronomy, Harvard University. 1947: B.S., London; 1951: Ph.D., London; 1967: M.A. (hon.), Harvard; 1961–1967: Professor of Mathematical Physics, Queen's University, Belfast. Specialties: theoretical atomic and molecular physics, planetary atmospheres. Articles: "Atom-Atom Collisions in Astrophysics: Theoretical Studies," *Rev. Mod. Phys.* (1967); "New Methods for Calculating Long Range Forces," *Adv. Chem. Phys.* (1967); "Collisions in the Ionosphere" *Adv. Atom. Molec. Phys.* (1968); with T. C. Degges, "Electron Cooling in the Upper Atmosphere," *Planet. Space Sci.* (1968); with G. W. F. Drake, "The Two-Photon Decay of Metastable Triplet Helium," *Astrophys. Journ.* (1968); "Radiative Transitions," in *Atomic Physics* (1969).

R. J. DAVIS, Astrophysicist, and Scientist-in-Charge, Project Celescope; Research Associate, Harvard College Observatory. 1951: B.A., Harvard; 1956: M.A., Harvard; 1960: Ph.D., Harvard; 1955: Astrophysicist, Varo Manufacturing Co.; 1955–1958: Teaching Fellow, Harvard College Observatory. Specialty: stellar astronomy (satellite instrumentation for ultraviolet intensities of stars, and interpretation of data obtained by these instruments); currently directing Project Celescope (second orbiting Astronomical Observatory satellite launched in 1968), the purpose of which is the construction of an accurate photometric map of the sky in each of four ultraviolet wavelength bands. Articles: "The Use of the Uvicon-Celescope Television System for Ultraviolet Astronomical Photometry," *Proc. 3rd Sym. on Photo-Electronic Image Devices as Aids to Scientific Observation* (1966);

"Factors Affecting the Transmittance of Lithium Fluoride and Barium Fluroide in the Vacuum Ultraviolet," *Journ. Opt. Soc. Amer.* (1966); "The Celescope Experiment," *SAO Special Rpt. 282* (1968).

W.A. DEUTSCHMAN, Operations Director for Project Celescope. 1960: B.S., Washington; 1962: M.S., Illinois; 1967: Ph.D., Colorado; 1962–1963: Research Fellow, High Altitude Observatory; 1963–1967: Research Assistant, National Center for Atmospheric Research. Specialties: ultraviolet spectra, laboratory generation, identification of solar ultraviolet lines. Currently research: satellite observation of the ultraviolet spectrum from early type stars; satellite astronomy and instrumentation. Articles: with L. House, G.A. Sawyer, "Comparison of Solar and Laboratory Iron Spectra in the Vacuum Ultraviolet," *Astrophys. Journ.* (1964); "New Inner Shell Resonance Line in Highly Ionized Sulfur and Chlorine," *Astrophys. Journ.* (1966); with L. House, "Additional Resonance Lines of Highly Ionized Sulfur, Chlorine, Argon and Potassium," *Astrophys. Journ.* (1967).

J.S. DICKEY, Jr. Geologist. 1963: A.B., Dartmouth College; 1966: M.Sc., University of Otago; 1964: Ph.D., Princeton University; 1963: Field Geologist, British Newfoundland Exploration. Specialty: igneous and metamorphic petrology. Current research: petrology. Article: "Ecologitic and Other Inclusions in the Mineral Breccia Member of the Deborah Volcanic Formation at Kakanui, New Zealand," *Am. Mineralogist* (1968).

D.F. DICKINSON, Radio Astronomer, Smithsonian-Harvard Radio Astronomy Program; Associate, Harvard College Observatory. 1955: B.S., Texas; 1965: Ph.D., California; 1959–1965: Graduate Student Research Assistant, Lawrence Radiation Laboratory; 1966: Research Radio Astronomer, Radio Astronomy Laboratory, University of California. Specialties: spectral line radio astronomy, recombination lines, hydroxyl radical emission and adsorption, galactic structure; nuclear physics–experimental high-energy; particle physics–pion-nucleon interactions. Articles: "Recoil Nucleon Polarization in Pi-Minus-Proton Elastic Scattering at 365 Mev," *Phys. Letters* (1966); with A.A. Penzias, K.B. Jefferts, A.E. Lilly, H. Penfield, "A Search for Line Emission from Singly Ionized Hydrogen Molecules," *Astrophys. Journ.* (1968); with M. Litvak, B. Zuckermann, "Conditions for Microwave Radiation from Excited OH Lambda–Doublet States," *Astrophys. Journ.* (1969); with B.M. Zuckermann, J.A. Ball, H. Penfield, "Time Variations in Galactic OH Emission Sources," *Astrophys. Letters* (1969).

C.G. FAZIO, Physicist; Lecturer, Department of Astronomy, Harvard University. 1954: B.S., B.A., St. Mary's; 1959: Ph.D., Massachusetts Institute of Technology; 1959–1961: Research Associate and Instructor, University of Rochester; 1961–1962: Assistant Professor, University of Rochester; 1961: Guest Associate Physicist, Brookhaven National Laboratory; 1968: NATO Senior Fellow, U.K. Atomic Energy Research Establishment, Harwell, England. Specialties: gamma-ray astronomy (ground-based and high-altitude balloon experiments, theoretical calculation of the origin of cosmic gamma rays), cosmic-ray physics. Current research: high-altitude balloon flights of detectors to search for cosmic gamma rays; design of a large-area gas Cerenkov counter for gamma-ray astronomy; operation of a 34-foot steerable optical reflector at Mt. Hopkins, Ariz. to detect atmospheric Cerenkov light produced by cosmic gamma rays; detection of cosmic x-rays and gamma rays by atmospheric fluorescence; theoretical calculations of the origin of cosmic rays. Articles: with J.B. Pollack, "Production of π-Mesons and Gamma

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Radiation in the Galaxy by Cosmic Rays," *Phys. Rev.* (1963); with J.F. Dolan, "The Gamma-Ray Spectrum in the Sun," *Rev. Geophys.* (1965); "Gamma Radiation from Celestial Objects," *Ann. Rev. Astron. Astrophys.* (1967); with H. Helmken, S. Cavrak, D. Hearn, "Search for Cosmic Gamma Rays with a Vidicon Soark Chamber," *Can. Journ. Phys.* (1968); with H. Helmken, G.H. Rieke, T.C. Weekes, "An Experiment to Search for Discrete Sources of Cosmic Gamma Rays in the 10^{11}- to 10^{12}-eV Region," *Can. Journ. Phys.* (1968); with H.F. Helmken, G.H. Rieke, T.C. Weekes, "Upper Limits to Gamma Ray Fluxes from Three Pulsating Radio Sources," *Nature* (1968).

E.L. FIREMAN, Nuclear Physicist; Lecturer, Harvard College Observatory, and Guest Scientist, Brookhaven National Laboratory. 1945: B.S., Carnegie Institute of Technology; 1948: Ph.D., Princeton; 1950–1956: Physicist, Brookhaven National Laboratory. Specialities: analysis of meteorites, meteoritic dust, and recovered satellites, and research in cosmic rays and solar flares. Was the first to measure tritium in recovered meteorites, to discover traces of tritium on a recovered satellite, to show that tritium is produced on the sun's surface during solar flares; has collaborated in analysis of data on the cosmic-ray exposure ages of meteorites and discovery of evidence for space erosion of meteoroids; collaborated in collecting dust samples from melted snow deep within the Greenland ice sheet for analysis of particles that showed the presence of cobalt-60 but not of aluminum-26 or argon-39 radioactivities in the dust. Current research: the orbits of meteorites and satellites to their isotope content to determine the variations in cosmic-ray intensity in interplanetary space, and collaborating on measurement of radioactivities in recently fallen chondritic meteorites, using a gamma-gamma coincidence spectrometer, studying sodium-22 and aluminum-26 in particular; lunar studies. Articles: "Multiple Fall of Pribram Meteorites Photographed. 10. Sodium-22 and Aluminum-26 Radioactivities in the Pribram Meteorites and its Relation to Meteorites Orbits," *Bul. Astron. Inst. Czechoslovakia* (1965); "Neutron Exposure Ages of Meteorites," *Zeits. fur Naturf.* (1966); "Evidence for Extraterrestrial Particles in Polar Ice," *Meteor Orbits and Dust* (1967); "Radioactivities in Meteorites and Cosmic-Ray Variations," Geochim. Cosmochim. Acta (1967); with R.H. McCorkell, C.C. Langway, Jr., "Al-26 and Be-10 in Greenland Ice," *Science* (1967); with J. De Felice, "Rare Gases in Phases of the Deelfontein Meteorite," *Journ. Geophys. Res.* (1968); "Freshly Fallen Meteorites from Portugal and Mexico," *Sky and Telescope* (1969).

M.R. FLANNERY, Physicist. 1961: B.Sc., Queen's University; 1964: Ph.D., Queen's University; 1964–1966: Lecturer (Assistant), Queen's University; 1966–1967: Research Associate, Joint Institute for Laboratory Astrophysics, Colorado; 1967–1968: Assistant Professor, Georgia Institute of Technology. Specialties: atomic and molecular processes; luminosity and ionization produced by meteors. Articles: "Energy Change Collisions between Ion Pairs and Third Bodies," *Journ. Phys. B (Proc. Phys. Soc.)* (1968); "Theoretical and Experimental Three-Body Ionic Recombination Coefficients," *Phys. Rev. Letters* (1968); with D.R. Bates, "Three-Body Recombination of Positive and Negative Ions," *Proc. Roy. Soc.* (1968); with H. Levy II, "H-H Interaction Potentials," *Journ. Phys. B (Atom. Molec. Phys.)* (1969); with H. Levy II, "Simple Analytic Expression for General Two-Center Coulomb Integrals," *Journ. Chem. Phys.* (1969); with D.R. Bates, "Three-Body Ionic Recombination at Moderate and High Gas Densities," *Journ. Phys. B (Atom. Molec. Phys.)* (1969).

G. FORTI, Physicist; Assistant in Astronomy, University of Florence, and Associate, Harvard College Observatory. 1964: Ph.D., Florence. Specialties: studies of solar activity, radio meteor astronomy. Articles: with G. Godoli, J. Noci, "Sugli indici di attivita dei filamenti solari," *Annali di Geofisica* (1965); with G. Godoli, "Sulla durata delle protuberanze quiescenti osservate sul disco," *Mem. SAIt.* (1965); with G. Godoli, "Ricerche sulle protuberanze solari a rapida evoluzione," *Mem. SAIt.* (1966); with K. Baker, "Preliminary Study of Meteor Streams at Faint Radio Magnitude," *Sm.-Harv. Radio Meteor Project Res. Rept. 14* (1966); "On the Width of the Geminid Shower at Faint Radio Magnitude," *IAU Sym. on Phys. and Dynamics of Meteors* (1968).

F.A. FRANKLIN, Astronomer and Physicist; Lecturer in Astronomy, Harvard University. 1954: B.A., Harvard; 1956: M.A., Harvard; 1962: Ph.D., Harvard; 1962–1963: Assistant Professor, University of Massachusetts. Specialties: planetary photometry, stability problems, investigations of concentration and scattering properties of small particles in the solar system. Collaborated in the discovery that the ice rings of Saturn are 45,000 miles wide and "probably less than 8 inches thick." Currently testing improved techniques and instrumentation to measure the earth's abedo (earthshine on the dark portion of the moon's surface before the first quarter and after the last quarter). Articles: with A.F. Cook, "On the Structure of Saturn's Rings," (abstract) *Astron. Journ.* (1965); with A.F. Cook, "Optical Properties of Saturn's Rings. II. Two-Color Phase Curves of the Two Bright Rings," *Astron. Journ.* (1965); with A.F. Cook, "Rediscussion of Maxwell's Adams Prize Essay on the Stability of Saturn's Rings," *Astron. Journ.* (1966); with A.F. Cook, "Particle Sizes in Saturn's Rings," *Astron. Journ.* (1966).

M.P. FRIEDMAN, Mathematician; Associate, Harvard College Observatory. 1951: B.S., New York; 1953: M.S., New York; 1961: Ph.D., New York; 1960–1961: Mathematician, Courant Institute, New York University; 1961–1965: Researcher, Aerophysics Laboratory, Massachusetts Institute of Technology. Specialties: analyses and interpretation of atmospheric density and temperature variations based on satellite-drag data from photographic tracking of satellites, and conservation equations of upper atmospheric studies; has developed a set of equations to describe the structure of the upper atmosphere. Articles: "A Description of a Computer Program for the Study of Atmospheric Effects on Sonic Booms," *NASA CR 157* (1965); "A Method for Calculating the Effect of Aircraft Maneuvers on Sonic Booms," *AIAA Journ.* (1965); "Behavior of the Sonic Boom shock near the Sonic Cutoff Altitude," *NASA CR 358* (1965); "A Three-Dimensional Model of the Upper Atmosphere," *SAO Special Rpt. 250* (1967).

E.M. GAPOSCHKIN, Mathematician. 1957: B.S., Tufts; 1959: D.N.A., Cambridge; 1969: Ph.D., Harvard; 1957–1958: Electrical Engineer, Minneapolis Honeywell Corp. Specialty: geodesy and geophysics (use of satellite data to determine the earth's geopotential and geometric figure; collaborated in extension of a basic computer program used in all analysis of satellite motions (the Differential Orbit Improvement program) to incorporate the effects of the tesseral harmonics in the geopotential. Articles: "Differential Orbit Improvement (DOI–3)," *SAO Special Rpt. 161* (1964); "Orbit Determination," "Tesseral Harmonic Coefficients and Station Coordinates from the Dynamic Method," *SAO Special Rpt. 200* (1966); "A Review of the Rotation of the Earth," *SAO Special Rpt. 236* (1966); "The Motion of the Pole and the Earth's Elasticity as Studied from the Gravity Field of the Earth by Means of Artificial Earth Satellites," *Proc. of the CIME Sym.* (1968); with G. Veis, "Comparison of and Results Obtained from Observing Stations," *Space Res. VIII* (1968); "Improved Values for the Tesseral Harmonics of the

Geopotential and Station Coordinates," *XII Plenary Meeting of COSPAR, Prague* (1969).

O.J. GINGERICH, Physicist; Associate Director, Central Bureau for Astronomical Telegrams; Professor of Astronomy and the History of Science, Harvard University. 1951: B.A., Goshen; 1953: M.A., Harvard; 1962: Ph.D., Harvard; 1955–1958: Director, American University Observatory, Beirut. Specialties: theoretical and numerical models of stellar atmospheres, especially the interpretation of ultraviolet spectra, and the history of astronomy. Currently completing analyses of the theoretical basis for spectral classification of A0–K0 stars and also for cool stars with surface temperatures around 2500°K; extensively studying Kepler's *Astronomia Nova* and preparing the first English translation; examining, with computer help, various early ephemerides to determine the internal consistency of the calculations and their accuracy for predicting planetary positions. Book: with W. Stahlman, *Solar and Planetary Longitudes from −2500 to ±2000* (1963). Articles: "Review of Opacity Calculations," *SAO Special Rpt. 167* (1964); "Eleven-Digit Regular Sexagesimals and Their Reciprocals," *Trans. Amer. Phil. Soc.* (1965); "Blanketing Approximations for Solar Models," *Journ. Quant. Spectrosc. Radiat. Transfer* (1966); with S.E. Strom and K.M. Storm, "Studies in Non-Gray Stellar Atmospheres. III. The Metal Abundances of Sirius and Vega," *Astrophys. Journ.* (1966); with C. de Jager, "The Bilderberg Model of the Photosphere and Low Chromosphere," *Solar Phys.* (1967).

M.D. GROSSI, Radio Physicist and Engineer; Consulting Scientist, Equipment Division, Raytheon Co., and Associate, Harvard University. 1948: doctorate, University of Engineering, Pisa; 1949: diploma in microwave physics, Italian Research Council, Florence; 1950–1958: Assistant Professor, University of Engineering, Communication Institute, Genoa; 1958–1960: Staff Engineer, Raytheon Co. Specialties: radar observations of meteor ionization and interpretation of the data, as well as determination and analysis of high-altitude winds from draft of meteor ionization trails; ionospheric-guided propagation; radio-frequency probing of planetary atmospheres and ionospheres; satellite electronic instrumentation; radio probing of magnetosphere; retroactivity measurements for very long-baseline interferometry. Developed instrumentation augmenting the Harvard-Smithsonian Radio Meteor Project to measure wind velocities at altitudes about 90 km. above ground level by collecting and processing Doppler information contained in radar returns from meteor trails. Articles: with J.I. Barker, "The Design of a Satellite-to-Satellite Communication Experiment to Explore HF/VHF Guided Propagation in the Lower Ionosphere," *Radio Sci.* (1966); with J.V. Harrington, "Global Probing of the Earth's Atmosphere and Ionosphere by a Satellite-to-Satellite Radio Occulation Method," *3rd Natl. Conf. on Aerospace Meterology, New Orleans* (1968).

S.E. HAMID, Celestial Mechanician; Associate, Harvard College Observatory. 1944: B.S., Cairo; 1950: Ph.D., Harvard; 1958–1961: Assistant Professor, Cairo University; 1961–1962: Consultant, Smithsonian Astrophysical Observatory; 1962–1965: Director, Operations Research Center, National Planning Institute, Cairo. Specialties: celestial mechanics, origin and evolution of meteor streams, orbital analysis of bodies in the solar system; current research on planetary theories, special perturbation, secular perturbations. Articles: "First-Order Planetary Theory," *SAO Special Rpt. 285* (1968); with B.G. Marsden, F.L. Whipple, "Influence of a Cometary Belt on Uranus and Neptune," *SAO Special Rpt. 299* (1969).

H.F. HELMKEN, Physicist; Lecturer in Astronomy, Harvard University, and Associate, Harvard College Observatory. 1957: B.S. (mathematics and physics), Manhattan; 1963: Ph.D., Massachusetts Institute of Technology. 1957–1959: A.E.C. Fellow, Massachusetts Institute of Technology; 1961–1964: Teaching Assistant, Massachusetts Institute of Technology. Specialties: cosmic-ray physics, X-ray and gamma-ray astronomy. Current research: gamma-ray astronomy using a vidicon spark chamber flown by high-altitude balloons; design of experiments for gamma-ray astronomy in the 0.3-Mev to 5-Mev, 5-Mev to 50-Mev, and 500-Mev to 5-Bev regions; collaboration in design and operation of the 32-foot gamma-ray mirror being installed on the SAO observatory on Mt. Hopkins, Ariz. Articles: with W. Kraushaar, G.W. Clark, G. Garmire, P. Higbie, M. Agogino, "Explorer XI Experiment on Cosmic Rays," *Astrophys. Journ.* (1965); "Application of the Vidicon Spark Chamber to Gamma-Ray Astronomy from High-Altitude Balloons and Satellites," *Can. Journ. Phys.* (1968); with C.G. Fazio, G.H. Rieke, T.C. Weekes, "An Experiment to Search for Discrete Sources of Cosmic Gamma Rays in the 10^{11}- to 10^{12}-eV Region," *Can. Journ. Phys.* (1968); with C.G. Fazio, S.J. Cavrak, D. Hearn, "A Search for Cosmic Gamma Rays with a Vidicon Spark Chamber," *Can. Journ. Phys.* (1968); with G.G. Fazio, G.H. Rieke, T.C. Weekes, "A Search for Discrete Sources of Cosmic Gamma Rays of Energies near 2×10^{12}eV," *Astron. Journ. (Letters)* (1968); with G.G. Fazio, G.H. Rieke, T.C. Weekes, "Upper Limits to Gamma Ray Fluxes from Three Pulsating Radio Sources," *Nature* (1968).

P.W. HODGE, Physicist; Professor of Astronomy, University of Washington. 1956: B.S., Yale; 1960: Ph.D., Harvard; 1956–1958: Teaching Fellow, Harvard University; 1957–1958, 1959–1960: Agassiz Fellow in Astronomy, Harvard University; 1958–1959: Margaret Weyerhauser Jewitt Fellow in Astronomy, Harvard University; 1959–1960: Parker Fellow in Astronomy, Harvard University; 1960–1961: Lecturer, Harvard University; 1960–1961: NSF Postdoctoral Fellow, Mt. Wilson and Palomar Observatories, and Research Fellow, California Institute of Technology; 1961–1962: Instructor, University of California, Berkeley; 1962–1965: Assistant Professor, University of California, Berkeley. Specialties: extragalactic problems, the Magellanic Clouds, meteoritic dust, interplanetary medium. Books: *Galaxies and Cosmology* (1966); with F.W. Wright, *The Large Magellanic Cloud* (1967); *Concepts of the Universe* (1969). Articles: "HII Regions in Twenty Nearby Galaxies," *Astrophys. Journ. Suppl. 18* (1969); with F.W. Wright, "Studies of the Large Magellanic Cloud. X. Photometry of Variable Stars," *Astrophys. Journ. Suppl. 17* (1969); with D.E. Brownlee, F.W. Wright, "Upper Limits to the Micron and Submicron Particle Flux at Satellite Altitudes," *Journ. Geophys. Res.* (1969).

L.G. JACCHIA, Physicist, Astrophysicist, and Geophysicist; Lecturer in Astronomy, Harvard University. 1932: Ph.D., Bologna. Specialties: upper atmosphere, artificial satellites, orbital analysis, meteors. Made one of the most significant discoveries of the IGY concerning the fluctuation of the rate of the change of period of the first satellites in a rhythmical cycle approximating the period of the sun's rotation and a correlation between this fluctuation and sun spots and flares. Has established the existence of, and studied in detail, the diurnal variation in the atmosphere to heights of 800 km, and has collaborated in the discovery of seasonal variations of helium density high above the polar regions. Has investigated the relation between exospheric temperature and geomagnetic indexes, concluding that the former varies with solar plasma velocities in a nearly linear fashion. Has conducted extensive collaborative analysis of the atmospheric trajectories of Super-Schmidt meteors. Articles: with F. Verniani, R.E. Briggs, "An Analysis of the Atmospheric Trajectories of 413 Precisely Reduced Photographic Meteors," *SAO Special Rpt. 175* (1965); "Atmospheric Structure and Its Variations at Heights above 200 km.," in *CIRA 1965 COSPAR Intl. Ref. Atmosphere* (1965); "Solar Plasma Velocity, Exospheric Temperature, and Geomagnetic Activity," *Journ. Geophys. Res.* (1965); with J. Slowey, "Diurnal and Seasonal Latitudinal Variations in the Upper Atmosphere," *SAO Special Rpt. 242* (1967); "Properties of the Upper Atmosphere Determined from Satellite Orbits," *Phil. Trans. Roy. Soc.* (London) (1967); "The Neutral Atmosphere above 200 km," in *Space Research IX* (1969); "Recent Advances in Upper Atmosphere Structure," *XII Plenary Meeting of COSPAR, Prague* (1969); with J.W. Slowey, I.G. Campbell, "A Study of the Semi-Annual Density Variation in the Upper Atmosphere from 1958 to 1966, based on Satellite Drag Analysis," *Planet. Space Sci.* (1969).

W. KALKOFEN, Astrophysicist; Lecturer in Astronomy, Harvard University. 1956: Vordiplom, Goethe University, Frankfurt; 1961: B.A., Harvard; 1963: Ph.D., Harvard; 1964–1966: Research Fellow, Harvard University; 1965: Visiting Lecturer in Astronomy, Yale University. Specialties: departures from local thermodynamic equilibriums, variable stars. Current research: influence of deviations from local thermodynamic equilibrium on the structure of model atmospheres, work with an important bearing on the quantitative analysis of stellar spectra; line formation in moving atmospheres. Articles: "Radiative Transfer in Lines for Media in Statistical Equilibrium," *SAO Special Rpt. 174* (1965); "Deviations from LTE in Stellar Atmospheres," *Journ. Quant. Spectrosc. Radiat. Transfer* (1966); with S. E. Strom, "The Effects of Deviations from LTE and Line Blanketing on Stellar Atmospheres in Range B5–A5," *Journ. Quant. Spectrosc. Radiat. Transfer* (1966); with D. M. Peterson, "Balmer Lines in Early-Type Stars," *Resonance Lines in Astrophysics*, NCAR publ. (1968); "Deviations from LTE in Stellar Photospheres," *Astrophys. Journ.* (1968); "The Simultaneous Solution of Strongly Coupled Transfer Equations," *Resonance Lines in Astrophysics*, NCAR publ. (1968); "Line Formation in Moving Atmospheres," *Astron. Astrophys.* (1969); with R. W. Noyes, "Observation and Interpretation of the Solar Lyman continuum," *Astron. Journ.* (1969).

Y. KOZAI, Astronomer and Celestial Mathematician; Astronomer, Tokyo Astronomical Observatory, and Associate, Harvard University. 1951: M.S., Tokyo; 1958: D.S., Tokyo. Specialties: zonal harmonics coefficients in the earth's gravitational potential by the use of precisely reduced Baker-Nunn observations; seasonal variability of the earth's potential. Has derived, with satellite-tracking data in studies of the earth's geo-potential, new values for the coefficients of the zonal harmonics of the earth's gravitational field. Articles: "The Earth's Gravitational Potential Derived from Satellite Motion," *Space Sci. Revs.* (1966); "Note on Expressions for Second-Order Short-Periodic Perturbations," *SAO Special Rpt. 234* (1966); "Lunisolar Perturbations with Short Periods," *SAO Special Rpt. 235* (1966); "Determination of Zonal Harmonic Coefficients," "The Zonal Harmonic Coefficients," *SAO Special Rpt. 200* (1966); "Determination of Love's Number by Satellite Observations," *SAO Special Rpt 236* (1966).

K. LAMBECK, Geodesist. 1963: B. Surv., New South Wales; 1967: D. Phil., Oxford; 1964: Research Worker, University of Delft; 1965: Research Worker, University of Athens; 1966–1967: Research Worker, Oxford University. Specialty: satellite altimetry; geophysics. Articles: "Effect of Random Atmospheric Refraction on Optical Satellite Observations," *SAO Special Rept. 269* (1968); "Scaling a Spatial Triangulation with Laser Range Measurements," *Studia Geophys. Geod.* (1968).

M. LECAR, Astrophysicist; Lecturer, Harvard College Observatory. 1951: B.S., Massachusetts Institute of Technology; 1953: M.S., Case Institute of Technology; 1963: Ph.D., Yale; 1961–1965; Staff member, Institute of Space Studies, New York; 1963–1965: Lecturer in Astronomy, Yale University Specialty: structure and evolution of galaxies. Articles: "Convergence of Lambda Iteration," *SAO Special Rpt. 174* (1965); "Radiative Transfer with Absorption Scattering," *Astrophys. Journ.* (1966); "Stellar Orbits in a Time-Varying Gravitational Field," *Astron. Journ.* (1966); "The Validity of the Valasov Equation," *Les Congres et Colloques de L'Universite de Liege* (1967); "The Dynamical Evolution of a Self- Gravitating Gas," *IAU Colloquium on the Gravitational N-Body Problem* (1967).

C. G. LEHR, Engineer; Lecturer in Mathematics, Northeastern University. 1943: B.S., Massachusetts Institute of Technology; 1948: M.S., Massachusetts Institute of Technology; 1954–1964. Manager, Microwave Group, Research Division, Raytheon Co. Specialties: electrical engineering, microwaves, lasers, mathematics, satellite-tracking systems. Articles: with L. A. Maestre, P. H. Anderson, "Satellite Range Measurements with a Laser at an Astrophysical Observing Station," in *Space Research VII* (1966); with L. A. Maestre, P. H. Anderson, "Satellite Ranging with a Laser and the Correction for Atmospheric Refraction," Special Vol. 25,Osterreichischen Zeitschrift fur Vermessungswesen (1967); with L. A. Maestre, P. H. Anderson, "A Ruby-Laser System for Satellite Ranging," in *Proc. Laser Range Instrumentation,* Society of Photo-Optical Instrumentation Engineers (1968).

M. W. LEVINE, Physicist. 1954: B.S.E.E., Massachusetts Institute of Technology; 1954: M.S.E.E., Massachusetts Institute of Technology; Ph.D., Purdue University; 1960–1965: Instructor, Purdue University; 1965–1966: Technical Staff Member, Mitre Corp.; 1966–1969: Engineer, Hewlett-Packard. Specialties: quantum electronics; atomic time and frequency standards. Current research: hydrogen maser; noise processes in time and frequency standards. Articles: "Cathodoluminescence of Ruby," *Journ. Appl. Phys.* "Design of Atomic Hydrogen Maser System for Satellite Experiments," *Proc. 21st Symp. on Frequency Control* (1967); with M. Baker, M. Levine, L. Mueller, "Progress in the Development of Hydrogen Masers," *Proc. 22nd Symp. on Frequency Control* (1968).

H. LEVY II, Physicist; Associate, Harvard College Observatory. 1961: B. S., Iowa State; 1966: Ph. D., Harvard University; 1966-1968: Post-doctoral student, Massachusetts Institute of Technology. Specialty: atomic and molecular physics. Current research: atom-atom, ion-atom, and atom-molecule inelastic collisions, particuarly slow collisions. Articles: "Born-Wave Calculation of Atom-Atom Inelastic Cross Sections: Description of Target Atoms by Elastic and Inelastic Form Factors," *Phys. Rev.* (1969); with M. R. Flannery, "H-H Interaction Potentials," *Journ. Phys. B (Atom. Molec. Phys.)* (1969); with W. R. Thorson, "Impact Ionization in Proton-Hydrogen Atom System," *Phys. Rev.* (1969); with M. R. Flannery, "Simple Analytic Expression for General Two-Center Coulomb Integrals," *Journ. Chem. Phys.* (1969).

A. E. LILLEY, Radio Astronomer; Research Associate, Yale University, and Associate Professor of Astronomy, Harvard University. 1950: B.S., Alabama; 1951: M.S., Alabama; 1954: Ph.D., Harvard; 1957–1959: Assistant Professor of Astronomy, Yale University; 1959–1963: Associate Professor of Astronomy, Harvard University. Specialty: radio astronomy. Did work in emission and absorption lines in cosmic radio waves at the NRL, which led to the first distance determination of a radio star by radio methods. Obtained results in graduate studies at Harvard in the determination of the atomic hydrogen content of dust clouds, confirming theories that dust clouds are internally rich in gas content. Articles: with J. P. Hagen, E. F. McClain. "Absorption of 21-cm Radiation by Interstellar Hydrogen," *Nav. Res. Lab. Rpt. 448* (1954); "Association of Gas and Dust from 21-cm Hydrogen Radio Observations," *Astrophys. Journ.* (1955); "Satellite Measurements of Cosmic and Planetary Radio Noise," *Space Age Astron.* (1962); with P. Palmer, F. T. Barath, A. H. Barrett, J. Copeland, D. Jones, "The Mariner 2 Microwave Radiometer Experiment and results," *Astron. Journ.* (1964); with P. Palmer, H. Penfield, B. Zuckerman, "Radio Astronomical Detection of Helium," *Nature* (1966); with P. Palmer, B. Zuckerman, H. Penfield, P. G. Mezger, "Detection of a new Microwave Spectral Line," *Nature* (1967); with B. Zuckerman, P. Palmer, H. Penfield, "On the Electron Temperatures of H II Regions," *Astrophys. Journ.* (1967); with P. Palmer, B. Zuckermann, H. Penfield, P. G. Mezger, "Helium Abundance Determinations from Radio Frequency Recombination Lines," *Astrophys. Journ.* (1969).

B.G. MARSDEN, Astronomer; Director, Central Bureau for Astronomical Telegrams, and Lecturer on Astronomy, Harvard University. 1959: B.A., Oxford; 1963: M.A., Oxford; 1966: Ph.D., Yale; 1959–1965: Assistant in Research, Yale University. Specialties: celestial mechanics, determination of orbits, numerical analysis, astronometry, astronomical constants, comets, minor planets. Book: ed., with A.G.W. Cameron, *International Conference on the Earth-Moon System* (1966). Articles: "On the Orbits of some Long-lost Comets," *Astron. Journ.* (1963); "An Attempt to Reconcile the Dynamical and Radar Determinations of the Astronomical Unit," *Bul. Astron.* (1965); "The Great Comet of 1965," *Sky and Telescope* (1965); with J.P. Wright, "Relativistic Investigations," *SAO Special Rpt. 236* (1966); "The Sungrazing Comet Group," *Astron. Journ.* (1967); "Comets and Nongravitational Forces," *Astron Journ.* (1968).

U.B. MARVIN, Geologist; Associate, Harvard University, Lecturer, Tufts. 1943: B.A., Tufts; 1946: M.A., Harvard; 1969: Ph.D., Harvard; 1952–1958: Mineralogist, Union Carbide Ore Co.; 1958–1961: Instructor, Tufts University. Specialty: mineralogical studies of meteoritic material including identification of cosmic dust. By discovery of zircon in meteorites, demonstrated that uranium and thorium are not dispersed in meteorites but rather concentrated in certain minor accessory minerals, particularly zircon and also whitlockite. Current research; petrological study of lunar samples; by identification of Ni-rich spherules in natural heavy-metal concentrates in preindustrial shoreline deposits discovered a new abundant occurrence of cosmic particles. Articles: with R.L. Fleischer, C.W. Naeser, P.B. Price, R.M. Walker, "Fossil Particle Tracks and Uranium Distributions in Minerals of the Vaca Muerta Meteorite," *Science* (1965); with R. Dodd, R. Van Schmus, "Merrihueite, a New Alkali-Ferromagnesium Silicate from the Mezo-Madaras Chondrite," *Science* (1965); with T.C. Marvin, "A Re-examination of the Crater near Crestone, Colorado," *Meteoritics* (1965); "Continental Drift," *SAO Special Rpt. 236*

(1966); "Black Magnetic Spherules from Pleistocene and Recent Beach Sands," *Geochim. Cosmochim. Acta* (1967); with C. Frondel, "Lonsdaleite, a Hexagonal Polymorph of Diamond," *Nature* (1967).

N.C. MATHUR, Electrical Engineer. 1955: B.A., Delhi University; 1958: D.I.I.Sc., Indian Institute of Science; 1961: M.S., Illinois; 1963: Ph.D., Illinois; 1958–1960: Lecturer, University of Roorkee; 1964–1966: Reader, University of Roorkee; 1967–1968: Research Associate, National Radio Astronomy Observatory. Specialties: radio astronomy; electromagnetic theory; radio-wave propagation; ionosphere. Current research: very long-baseline interferometry. Articles: with K.C. Yeh, "Multiple Scattering of Electromagnetic Waves by Random Scatterers of Finite Size," *Journ. Math. Phys.* (1964); with G.W. Swenson, Jr., "The Circular Array in the Correlator Mode," *Proc. Inst. Radio and Electronic Engineers (1967);* with G.W. Swenson, Jr., "The Interferometer in Radio Astronomy," *Proc. IEEE* (1968); with G.W. Swenson, Jr., "On the Space-Frequency Equivalence of a Correlator Interferometer," *Radio Sci.* (1969); "A Pseudo-Dynamic Programming Technique for the Design of Correlator Supersynthesis Arrays," *Radio Sci.* (1969).

R.E. MCCROSKY, Astronomer and Scientist-in-Charge, Prairie Meteorite Network; Associate, Harvard University. 1942–1943: Akron; 1943–1944; Denison; 1952: B.S., Harvard; 1956: Ph.D., Harvard; 1947–1951: Participant, Harvard Meteor Project; 1953–1955 (intermittently): Research Assistant, Harvard Meteor Project; 1953–1954: Teaching Fellow, Harvard University: 1956–1959: Research Fellow, Harvard University; 1956–1957: Senior Research Assistant, Harvard University: 1956–1960: Associate Harvard University. Specialty: photographic and spectral observations of meteors and interpretation of the data. Currently supervising a system of unmanned camera stations in the midwestern U.S., the first large-scale attempt orthicon observations of faint meteors observed simultaneously with radar. Articles: with A. Posen, "Orbital Elements of Photographic Meteors," *Sm. Cont. Astrophys.* (1960); with R.K. Soberman, "Results from an Artificial Iron Meteoroid at 10 km/sec" *Sm. Cont. Astrophys.* (1963); with H. Boeschenstein, Jr., "The Prairie Meteorite Network," *Journ. Soc. Photo-Opt. Inst. Engrs.* (1965); "Orbits of Photographic Meteors," *SAO Special Rpt. 252* (1967).

G.H. MEGRUE, Geochemist and Cosmochemist. 1957: B.A., Amherst; 1960: M.A., Columbia; 1962: Ph.D., Columbia;1962–1964: Research Associate, Brookhaven National Laboratory; 1964–1966: Associate Chemist, Brookhaven National Laboratory; 1966: Senior Mass Spectrometrist, State University of New York, Stony Brook. Specialties: research in geochemistry and cosmochemistry; trace-element distribution and geochronology of oceanic basalt; rare-gas chronology of stony meteorites; detection of cosmic dust in ocean sediments; potassium-argon dating of alunite; continental drift and sea-floor spreading. Currently investigating stable rare gases in meteorites, in particular chondrites, in an attempt to correlate stable rare gases with mineralogical data by volatilizing samples with a small laser; studying Ethiopian rift system. Articles: with R.W. Stoenner, "Rare Gas Contents with K–Ar Ages of Stony Iron and Achondritic Meteorites," *Trans. Amer. Geophys. Union* (1965); with P.F. Kerr, "Alteration of Sandstone Pipes, Laguna, New Mexico" *Geol. Soc. Amer.* (1965); "Rare Gas Chronology of Calcium-Rich Achondrites," *Jour. Geophys. Res.* (1966); Isotopic Analysis of Rare Gases with a Laser Microprobe," *Science* (1967); "Rare Gas Chronology of Hypersthene Achondrites and Pallasites," *Journ. Geophys. Res.* (1968); "Distribution and Origin of

Primordial Helium, Neon, and Argon in the Fayetteville and Kapoeta Meteorites," in *Meteorite Research* (1969).

D.H. MENZEL, Astrophysicist; Professor of Astronomy and Paine Professor of Practical Astronomy, Harvard University. 1920: B.A., Denver; 1921: M.A., Denver; 1923: M.A., Princeton; 1924: Ph.D., Princeton; 1942: M.A. (hon.), Harvard; 1954: Sc.D., (hon.), Denver, 1924–1925: Instructor, University of Iowa; 1925–1926: Assistant Professor, Ohio State; 1926–1932: Assistant Astronomomer, Lick Observatory; 1928–1931: Exchange Professor, University of California at Berkeley; 1932–1935: Assistant Professor, Harvard University; 1935–1938: Associate Professor, Harvard University; 1946–1949: Chairman, Department of Astronomy, Harvard University; 1946–1954: Associate Director for Solar Research, Sacramento Peak Station, Sunspot, N.M.; 1951–1952: Director, Sacramento Peak Station; 1952–1954: Acting Director, Harvard College Observatory; 1954–1966: Director, Harvard College Observatory. Specialties: astrophysics, especially problems of the sun and interpretation of stellar and nebula spectra; planetary atmospheres; wave mechanics and atomic spectra; theory of reactions and equilibria at high temperatures; radio propagation; ionosphere, spectroscopy, geophysics. Has contributed to the field of astrophysics predominantly in solar studies, involving eclipses, the chromosphere and corona (including developing the coronograph) and the effect of magnetic fields on sun spots and solar activity. Current research: coronal polarization, magnetohydrodynamics; solar and stellar stmospheres. Books: *Mathematical Physics* (1953); *Fundamental formulas of Physics* (1955); *Our Sun* (1959); *Physical Processes in Ionized Plasmas* (1962), reprint of earlier papers from *Astrophys. Journ.; A Field Guide to the Stars and Planets* (1964); with B.W. Shore, *Principles of Atomic Spectra* (1968); with F.L. Whipple, G.de Vaucouleurs, *Survey of the Universe* (1970). Articles: "The Moon as an Abode of Life?" *Proc. Am. Phil. Soc.* (1969); "Venus Past, and the Distance of the Sun," *Proc. Am. Phil. Soc.* (1969); "What Day is Today?" *Highlights for Children* (1969); "What We Hope to Find on The Moon," *Highlights for Children* (1969).

L. MERTZ, Research Associate in Astronomy; Associate, Harvard College Observatory. 1951: A.B., Princeton University; 1957: A.M., Harvard University; 1969: Ph.D., Harvard University; 1951–1954: Physicist, Baird Associates; 1959–1968: Vice-President, Block Associates. Specialties: Fourier spectrometry; optical instruments. Book: *Transformations in Optics* (1965).

H.E. MITLER, Physicist; Associate, Harvard College Observatory; Lecturer in Astronomy, Harvard University. 1953: B.S., City College of New York; 1960: Ph.D., Princeton; 1952: Junior Physicist, Nuclear Development Associates; 1957–1958: Instructor, Princeton; 1959–1961: Research Associate and Adjunct Lecturer in Physics, Brandeis University. Specialties: nuclear structure; nuclear reactions, especially in nucleosynthesis and geophysical contexts; history of evolutionary processes in the solar system. Has found a relatively simple analytical method for obtaining the total number of neutrons, protons, and heavier particles evaporated from excited nuclei and has obtained an improved neutron production spectrum; has solved the problem of spallation production of nuclei in spherical meteoroids by cosmic rays. Current research: electron screening in dense thermonuclear plasmas; origin of red shift in quasars. Articles: "Origin of the Rare Light Nuclides," *Sym. on High-Energy Processes in Astrophys.* (1967); "The Total

Binnding Energy of Electrons in a Neutral Atom," *Am. Journ. Phys.* (1967); "The Coupling of Matter and Radiation in Cosmology," *SAO Special Rpt. 281* (1968).

P.A. MOHR, Geologist. 1952: B. Sc., Manchester; 1955: Ph.D., Manchester; 1957–1962, 1964–1967: Associate Professor, Geophysical Observatory, Addis Ababa; 1963: Research Fellow, Cambridge University. Specialty: tectonics and volcanism of world ridge-rift system. Current research: evolution of Ethiopian rift system; crustal deformation in Ethiopia. Book: *The Geology of Ethiopia* (1962). Articles: "Genesis of the Cambrian Manganese Carbonate Rocks of North Wales," *Journ. Sed. Pet.* (1964); with P. Gouin, "Gravity Traverses in Ethiopia," *Bul. Geophys. Obs. Addis Ababa* (1964); with A. S. Rogers, J. A. Miller, "Age Determination on Some Ethiopian Basement Rocks," *Nature* (1965); "The Ethiopian Rift System," *Bul. Geophys. Obs. Addis Ababa* (1967); "Annular Faulting in the Ethiopian Rift System," *B.G.O.A.A.* (1968); "Transcurrent Faulting in the Ethiopian Rift System," *Nature* (1968).

R.W. NOYES, Astrophysicist; Lecturer in Astronomy, Harvard University. 1957: B.A., Haverford; 1963: Ph.D., California Institute of Technology. Specialty: solar physics (solar spectroscopy from orbiting observations, and related laboratory investigations). Current research: acquisition and analysis of data from orbiting solar observatories, especially spectroheliograms in the extreme ultraviolet; ground-based observations of the sun from southwestern observatories, infrared stellar photometry; infrared solar spectroscopy; collaborating in the development of new stellar and solar facilities at the Smithsonian Mt. Hopkins observatory, Ariz. Articles: with O.J. Gingerich, L. Goldberg, "On the Infrared Continuum of the Sun and Stars," *Astrophys. Journ.* (1966); "Observational Studies of Velocity Fields in the Solar Photosphere and Chromosphere," *Intl. Astron. Union Sym. No. 28* (1967); "Observational Studies of the Solar Intensity Profile in the Far Infrared and Millimeter Regions," *Solar Phys.* (1967); "The Solar Continuum in the Far Infrared and Millimeter Regions," *Phil. Trans. Roy. Soc.* (1967); with L. Goldberg, W.H. Parkinson, E.W. Reeves, G.L. Withbroe, "Ultraviolet Solar Images from Space," *Science* (1968); with W. Kalkofen, "Observations and Interpretation of the Solar Lyman continuum," *Astron. Journ.* (1969).

Y. NOZAWA, Engineer; Associate, Harvard College Observatory. 1955: B.E., University of Tokyo; 1961: M.S., Massachusetts Institute of Technology; 1968: Sc. D., Massachusetts Institute of Technology. Specialty: space instrumentation. Current research: behavior of UVICON television (celescope) in space. Book: *Space Technology* (1963). Articles: "A Digital Television System for a Satellite-Borne Ultra-Violet Photometer," *Adv. Elect. Elect. Phys.* (1966); with B.J.Tucker, "Digital Video Data Transmission System for Photometric Television," *Supp. IEEE Trans. Aerospace and Electronic System* (1966); "Characteristics of Television Photometry," *Adv. Elect. Elect. Phys.* (1969).

C. PAPALIOLIOS, Physicist; Assistant Professor, Harvard University. 1953: B.S., Rensselaer Polytechnic Institute; 1960: M.A., Harvard; 1965: Ph.D., Harvard. Specialties: physics of the upper atmosphere, atomic and molecular physics, quantum theory. Current research: search for optical pulsars. Articles: with N.P. Carleton, "Measured Variation of the Electronic Transition Moment of the Vegard-Kaplan Bands in N_2" *Journ. Quant. Spectrosc. Radiat, Transfer* (1962); "Experimental Test of a Hidden Variable Quantum Theory," *Phys. Rev. Letters* (1967); with N.P. Carleton, P. Horowitz, W. Liller, "Optical Search for Pulsations from Pulsating Radio Source CP1919," *Science* (1968).

G.H. PAYNE-GAPOSHKIN, Astronomer; Phillips Astronomer and Professor of Astronomy Emerita, Harvard University. 1923: A.B., Cambridge; 1925: Ph.D., Radcliffe; 1942: D. Sc. (hon.), Wilson; 1943: D. Sc. (hon.), Smith; 1950: M.A., D. Sc. (hon.), Cambridge; 1952: D. Sc. (hon.), Western College for Women. Specialties: spectroscopy and variable stars. Articles: "Novae and Novalike Stars," *Ann. Rev. Astron. Astrophys.* (1963); "The 1960 Minimum of R Coronae Borealis," *Astrophys. Journ.* (1963); "Otto Struve," *Yearbook of the Am. Phil. Soc.* (1963); with S. Gaposhkin, "Variable Stars in the Small Magellanic Cloud," *Sm. Astrophys.*(1966).

M.R. PEARLMAN, Physicist. 1963: B.S., Massachusetts Institute of Technology; 1968: Ph.D., Tufts University. Specialties: solid-state physics; optics; electronics. Current research: atmospheric studies; laser systems. Articles: with R.H. Webb, "Characteristics of Traveling Wave Helices in E.S.R. Spectrometers," *Rev. Sci.Inst.* (1967); with N.V. Nghia, R.H. Webb, "Recent Results in Dynamic Polarization Studies of Liquids," *Chem Phys. Letters* (1968); with R.H. Webb, N.V. Nghia, E.H. Poindexter, P.J. Caplan, J.A. Potenza, "Dynamic Nuclear Polarization: Collision Mechanics in Fluorocarbon Solutions," *Journ. Chem. Phys.* (1969).

J. B. POLLACK, Astrophysicist; Associate, Harvard University. 1960: B.A., Princeton; 1962: M.A., California, Berkeley; 1965: Ph.D., Harvard; 1961: Research Worker Lick Observatory; 1962: Research Worker, Institute for Space Studies, New York. Specialties: planetary astronomy, including construction of model atmospheres and cloud layers, and theoretical analysis of visual, infrared, radar and radio observatory of the planets; plantary biology. Articles: with G. G. Fazio, "Nuclear Interactions of Cosmic Rays as the Source of the Synchrotron Radiating Particles of Our Galaxy," *Astrophys. Journ.* (1965); with C. Sagan, "Polarization of Thermal Emission from Venus," *Astrophys. Journ.* (1965); "The Microwave Phase Effect of Venus," *Icarus* (1965; with C. Sagan, "The Infrared Limb-Darkening of Venus," *Journ. Geophys. Res.* (1965); with C. Sagan, "An Analysis of Microwave Observations of Venus," *Journ. Res. NBS* (1965); with C. Sagan "Properties of the Clouds of Venus," *Proc. of the Caltech-JPL Lunar and Planetary Conf.* (1966).

B. N. POWELL, Geologist. 1964: B.A., Amherst College; 1966: M.A., Columbia University; 1969: Ph.D., Columbia University. Specialties: igneous and metamorphic petrology; meteoritics. Current research: petrology of stony-iron and stony meteorites; petrology of lunar surface. Article: "Petrology and Chemistry of Mesosiderites. I. Textures and Composition of Nickel-Iron," *Geochim. Cosmochim. Acta* (1969).

G. H. RIEKE, Physicist. 1964: B.A., Oberlin College; 1965: M.A., Harvard University; 1969: Ph.D., Harvard University. Specialty: gamma-ray astronomy. Articles: "An Experiment to Search for Discrete Sources of Cosmic Gamma Rays in the 10^{11} to 10^{12} eV Region," *Can. Journ. Phys.* (1968); "A Search for Discrete Sources of Cosmic Gamma Rays of Energies near 2×10^{12} eV," *Astrophys. Journ.* (1968); with G. G. Fazio, H. F. Helmken, T. C. Weekes, "Upper Limits to Gamma-Ray Fluxes from Three Pulsating Radio Sources," *Nature* (1968); with T. C. Weekes, "Production of Cosmic Gamma Rays by Compton Scattering," *Astrophys. Journ.* (1969).

G. B. RYBICKI, Physicist; Lecturer in Applied Mathematics and Astronomy, Harvard University. 1956: B.S., Carnegie Institute of Technology; 1957: M.A., Harvard; 1965: Ph.D., Harvard; 1960–1964: Research Assistant, Harvard University; 1962–1964: Senior Scientists, AVCO RAD, Wilmington, Mass. Specialty: theoretical numerical models of stellar atmospheres. Has derived radiative equations for a medium with small stochastically defined opacity and energy fluctuations, the theory providing a description of the solar atmosphere, which has statistically defined inhomogeneities resulting from an underlying convection zone. Current research: theoretical work on the theory of line formation in stellar atmospheres; theoretical work on self-gravitating systems. Articles: with P. D. Usher, "The Generalized Riccati Transformation as a Simple Alternative to Invariant Imbedding," *Astrophys. Journ.* (1966); "Non-LTE Line Formation with Spatial Variations in Doppler Width," *Journ. Quant. Spectrosc. radiat. Transfer* (1966); "Spectral Line Formation in Variable-Property Media: The Riccati Method," *Astrophys. Journ.* (1967); "Computational Methods for Non-LTE Line-Transfer Problems," *Methods in Computational Physics* (1967); with M. Krook, "Radiative Transfer in Fluctuating Media," *Transport Theory, SIAM-AMS Proc.* (1968); with D. G. Hummer, "Redshift Line Profiles from Differentially Expanding Atmospheres," *Astrophys. Journ. (Letters)* (1968).

W. W. SALISBURY, Electron and Nuclear Physicist; Research Associate, Harvard University. 1919–1920: Texas A. and M.; 1924: B.S. Iowa; 1927–1928: California, Berkeley; 1950: D. Sc., Cornell College; 1958–1965: Scientist, Varo, Inc., Garland, Tex. Specialties: applications of high-power density microwaves and the generation of visual light directly from the oscillation of free electrons; design and construction of cyclotrons, research and design in the field of high-power vacuum tubes, research and design of radio astronomy equipment. Designed and built the NRL 50-foot radio telescope, one of the first radio telescopes; has done recent research in the generation of visual light from the oscillation of free electrons and on the effect of simulated lighting on meteoric dust. Currently studying lunar communications, Sagnac effect, and magnetic waves in conducting spheres. Articles: with D. H. Menzel, "The Origin of Cosmic Rays," *Nucleonics* (1948); with D. K. Bailey, R. Bateman, L. V. Berhner, H. G. Booker, G. F. Montgomery, E. M. Purcell, J. B. Miesher, "A New Kind of Radio Propagation at Very High Frequencies over Long Distances," *Phys. Rev.* (1952); "Multi-Phase Magnetic Propulsion of Projectiles," *Proc. of the 3rd Sym. on Hypervelocity* (1959); "Nonlinear Effects in Radiation Generation through the Coupling of Electron Beams with Diffraction Gratings," *Conf. on Nonlinear Processes in the Ionosphere* (1964); "Generation of Light from Free Electrons," *Science* (1966); "A Method for Translunar Radio Communication," *Nature* (1966).

M. R. SCHAFFNER, Engineer; Staff Member, Massachusetts Institute of Technology. 1947: doctorate in electrical engineering, Pisa; 1961–1963: advanced study, Massachusetts Institute of Technology; 1953–1961: Staff, Microwave Center, Italian Research Council; 1954–1961: Teacher, Italian Air Force Officers' School. Specialties: microwaves, radar, data processing; currently developing a new system for data processing and special-purpose computers. Articles: "The Circulating Page Loose System–A New Solution for Data Processing," *Radio Meteor Project, Res. Rpt. No. 15* (1966); "Analysis of the CPL System. Part I." *SAO Special Rpt. 291* (1968); "CPL Processor for Weather Radar," 13th Conf. on Radar Meteorology, Montreal (1968).

R. E. SCHILD, Astronomer. 1962: B.S., University of Chicago; 1963: M.S., University of Chicago; 1966: Ph.D., University of Chicago; 1966–1969: Research Fellow, Mount Wilson and Palomar Observatories. Specialties: stellar structure, spectroscopy, and photometry; spectral classification; galactic structure. Articles: "Ages and Structures of Stars in the h and x Persei Association," *Astrophys. Journ.* (1967); with J. B. Oke, "A Practical Method to Improve the Quantum Efficiencies of Photomultiplier Tubes," *Appl. Optics* (1968); "HDE 310376: A Rapid Variable Similar to Sco Y-I," *Astrophys. Journ.* (1969); with W. A. Hiltner, R. F. Garrison, "Spectral Classification of Southern OB Stars," *Astrophys. Journ.* (1969); with W. A. Hiltner, N. Sanduleak, "A Spectroscopic and Photometric Study of the Association Sco OBI," *Astrophys. Journ.* (1969).

L. SEHNAL, Astronomer. 1954: M.A., Charles University; 1959: Ph.D., Czechoslovak Academy of Science; 1954–1969: Astronomer, Astronomical Institute, Oudrejov. Specialty: celestial mechanics and its applications to orbits of artificial earth satellites. Current research: perturbations of orbits of artificial satellites caused by atmospheric drag, radiation pressure, and geomagnetism. Articles: with S. B. Mills, "The Short Periodic Drag Perturbations of Satellites' Orbits," *SAO Spec. Rpt. 223* (1966); "The Motion of a Charged Satellite in the Earth's Magnetic Field," *SAO Spec. Rpt. 271* (1968); "Radiation Pressure Effects in the Motion of Artificial Satellites," *Space Research X* (1969); with P. Lála, "Short Periodic Radiation Pressure Perturbations of Satellites' Orbits," *Bul. Astron. Inst. Czech.* (1969).

Z. SEKANINA, Physicist. 1959: R.N.Dr., Charles University; 1963: C.Sc., Charles University; 1959–1966: Astronomer, Stefanik Observatory; 1967–1968: Astronomer, Center for Numerical Mathematics, Charles University; 1968–1969: Visiting Astronomer, Institut d'Astrophysique, Université de Liège. Specialty: cometary physics and dynamics. Current research: Radio Meteor Project. Articles: "Disruption of Comet P/Biela and Explosive Mechanisms of Cometary Splits," *Bul. Astron. Inst. Czech.* (1968); "A Dynamical Investigation of Comet Arend-Roland 1957 III," *Bul. Astron. Inst. Czech.* (1968); "Motion Splitting and Photometry of Comet Wirtanen 1957 VI," *Bul. Astron. Inst. Czech.* (1968); "On the Perturbations of Comets by Nearby Stars," *Bul. Astron. Inst. Czech.* (1968).

R. B. SOUTHWORTH, Physicist; Lecturer in Astronomy, Harvard University, and Assistant Director, Central Bureau for Astronomical Telegrams, International Astronomical Union. 1950: B.A., Swarthmore; 1960: M.A., Harvard; 1961: Ph.D., Harvard; 1952–1953: Research Assistant, Massachusetts Institute of Technology; 1953–1961: Research Assistant, Harvard College Observatory. Specialties: investigations of concentrations and scattering properties of small particles in the solar system; radar observations of meteor ionization and interpretation of the data as well as determination and analysis of high-altitude wind from drift of meteor ionization trails; photometry of comets. Has collaborated in computation of the ablation coefficient for a meteor, which represents the rate of loss of mass by a meteor moving through the atmosphere, and in determination of the distribution of the radiants of sporadic meteors. Currently analyzing films of comets from nine Baker-Nunn cameras equipped with a plastic defocusing device for measurement of image density for the purpose of correlations with solar phenomena and for indications of the physical behavior of comets; conducting an initial study to solve the problem of transferring observed stellar magnitudes to the Baker-Nunn color system. Articles: "The Size Distribution of the Zodiacal Particles," *Ann. N.Y. Acad. Sci.* (1964); "Phase Function of the Zodiacal Cloud," *SAO Special Rpt.*

236 (1967); "Space Density of Radio Meteors," *SAO Special Rpt. 239* (1967); with C. S. Nilsson, "The Flux of Meteors and Micrometeoroids in the Neighborhood of the Earth," *SAO Special Rpt. 263* (1967).

S. E. STROM, Physicist and Astrophysicist; Associate Professor of Astronomy, State University of New York at Stony Brook. 1962: B.A., Harvard; 1964: M.A., Ph.D., Harvard; 1963–1964: Teaching Fellow in Astronomy, Harvard University. Specialties: Stellar atmospheres (problems of line blanketing, departures from LTE); stellar abundance analysis (Am and Ap stars, subdwarfs, problems of stellar helium content). Current research: globular cluster horizontal branch, post-horizontal branch stars and blue stragglers. Articles: with W. Kalkofen, "The Effects of Deviations from LTE and Line Blanketing on Stellar Atmospheres in the Range B5 to A5," *Journ. Quant. Spectrosc. Radiat. Transfer* (1966); with R. L. Kurucz, "A Statistical Procedure for Computing Line-Blanketed Model Stellar Atmospheres with Applications to the F5 IV Star Procyon," *Journ. Quant. Spectrosc. Radiat. Transfer* (1966); with J. G. Cohen, K. M. Strom, "Analysis of F and G Subdwarfs I. The Location of Subdwarfs in the Theoretical H-R Diagram," *Astrophys. Journ.* (1967); with K. M. Strom, "The Helium Content of Subdwarfs," *Astrophys. Journ.* (1967); with J. G. Cohen, "Analysis of F and G Subdwarfs. II. A Model Atmosphere Abundance Analysis of the Subdwarf HD140283 and HD19445," *Astrophys. Journ.* (1968); with P. S. Conti, "The Early A Stars. II. Model Atmosphere Abundance Analysis of Eight Stars in the Pleiades," *Astrophys. Journ.* (1968).

W. A. TRAUB, Physicist. 1962: B.S., Wisconsin; 1964: M.S., Wisconsin; 1968: Ph.D., Wisconsin. Specialty: High-resolution optical spectrometry. Current research: measurement of absorption lines in planetary atmospheres and interstellar medium with PEPSIOS spectrometer. Articles: with F. L. Roesler, "Precision Mapping of Pairs of Uncoated Optical Flats," *Appl. Optics* (1966); with F. L. Roesler, M. M. Robertson, V. W. Cohen, "Spectroscopic Measurement of the Nuclear Spin and Magnetic Moment of 39 Argon," *Journ. Opt. Soc. Am.* (1967).

S. TSURUTA, Physicist; Research Associate, Harvard University. 1956: B.A., Washington; 1959: M.A., Columbia; 1964: PhD., Columbia; 1958–1959: Research Assistant, Columbia University; 1959–1960: Lecturer, Queens College, New York. Specialties: problems of highly degenerate matter, such as white dwarf stars, neutron and hyperon stars; problems of gamma-ray and X-ray sources and quasi-stars; application of general relativity, nuclear physics, and particle physics to various problems in astrophysics; theory of later stages of evolution, such as supernovae and their remnants; atmospheres of dense stars; pulsars; radiation gas dynamics. Articles: with A. G. W. Cameron, "Cooling and Detectability of Neutron Stars," *Can. Journ. Phys.* (1966); with A. G. W. Cameron, "Some Effects of Nuclear Forces on Neutron-Star Models," *Can. Journ. Phys.* (1966); with A. G. W. Cameron, "Rotation of Neutron Stars," *Nature* (1966); with C. J. Hansen, "Vibrating Neutron Stars," *Can. Journ. Phys.* (1967); with F. W. Stecker, G. G. Fazio, "The Effects of the Decays of Nucleon Isobars and Hyperons on the Cosmic-Ray Spectrum," *Astrophys. Journ.* (1968); "Equilibrium Composition of Matter at High Densities," in *Nucleosynthesis* (1968); with J. W. Truran, W. D. Arnett, A. G. W. Cameron, "Rapid Neutron Capture in Supernova Explosions," *Astrophys. Space Sci.* (1968).

G. VEIS, Geodesist; Associate, Harvard College Observatory, and Professor, National Technical University, Athens. 1951: Dip. Eng., National Technical, Athens; 1956: École Nationale des Sciences Geographiques, Paris, and University of Paris; 1958: Ph.D., Ohio

State. Specialties: satellite geophysics; optical satellite tracking, motion of spin axis of earth. Current research: determination of radius of earth and other parameters from satellite data; laser ranging. Book: *The Use of Artificial Satellites for Geodesy, Vol. I* (1963) *Vol. II* (1965). Articles: "The Deflection of the Vertical of Major Geodetic Datums and the Semimajor Axis of the Earth's Ellipsoid as Obtained from Satellite Observations," *Space Res. V* (1965); with F. L. Whipple, "Erdvermessung mit Satelliten," *Bild der Wissenschaft* (1965); ed., with C. A. Lundquist, "Geodetic Parameters for a 1966 Smithsonian Institution Standard Earth," *SAO Special Rpt. 200* (1966); "Differential Orbit Improvement Program for Lunar Orbiters," *SAO Special Rpt. 236* (1966); "Geodetic Interpretation of the Results," *Space Res. VII* (1967); "Results from Geometric Methods," *Space Res. VII* (1967).

R. F. C. VESSOT, Physicist. 1951: B.A., McGill University; 1954: M.Sc., McGill University; 1956: Ph.D., McGill University; 1955–1960: D.S.R. Staff Member, Massachusetts Institute of Technology; 1960–1969: Manager, Maser Research and Development, Hewlett-Packard. Specialties: molecular beams; atomic clocks; physical electronics; long-baseline interferometry. Current research: gravitational redshift experiment; hydrogen relaxation studies on surfaces; precise time keeping; doppler-canceling telemetry systems. Articles: with J. Vanier, "Exchange Collisions, Wall Interactions, and Resettability of the Hydrogen Maser," *IEEE Trans. on Instrumentation and Measurement* (1964); "Frequency Stability Measurements between Several Atomic Hydrogen Masers," in *Quantum Electronics III* (1964); with D. Kleppner, H. C. Berg, S. B. Crampton, N. F. Ramsey, H. E. Peters, J. Vanier, "Hydrogen-Maser Principles and Techniques," *Phys. Rev.* (1965); with H. Peters, J. Vanier, R. Beekler, D. Halford, R. Hanrach, D. Allan, D. Glaze, C. Snider, J. Barnes, L. Cutler, "An Intercomparison of Hydrogen and Cesium Standards," *IEEE Trans. on Instrumentation and Measurement* (1966); with L. Mueller, J. Vanier, "The Specification of Oscillator Characteristics from Measurements Made in the Frequency Domain," *Proc. IEEE* (1966); with D. Kleppner, N. F. Ramsey, "An Orbiting Clock Experiment to Determine the Gravitational Red Shift," *Journ. Astrophys. Space Sci.* (1969).

T. C. WEEKES, Astrophysicist; Visiting Lecturer in Physics, Harvard University. 1962: B. Sc., National University of Ireland; 1966: Ph.D., National University of Ireland; 1963–1966: Lecturer, National University of Ireland; 1966–1967: NRC–NAS Post-doctoral Research Associate; SOA. Specialties: detection of cosmic-ray-induced air showers by optical and radio methods; detection of high-energy gamma rays from cosmic sources. Currently searching for point sources of cosmic gamma rays by atmospheric Cerenkov light technique using 34-foot optical reflector on Mount Hopkins, Ariz. Articles: with J. V. Jelley, J. H. Fruin, N. A. Porter, F. G. Smith, R. A. Porter, "Radio Pulses from Extensive Cosmic-Ray Air Showers," *Nature* (1965); "X-Ray and Gamma-Ray Astronomy," *Sci. Progr. Oxf.* (1966); with G. H. Rieke, "Production of Cosmic Gamma Rays by Compton Scattering in Discrete Sources," *Astrophys. Journ.* (1969).

G. C. WEIFFENBACH, Director, Geoastronomy. 1949: A.B., Harvard University; 1958: Ph.D., Catholic University; 1951–1969: Physicist, Supervisor, Research and Analysis, Johns Hopkins University Applied Physics Laboratory. Specialties: microwave spectroscopy; satellite tracking; satellite geophysics; satellite navigational systems; high-accuracy mensuration; electromagnetic wave propagation; geoastronomy. Book: with A. M. Stone, *Radio Doppler Method of Using Satellites for Deodesy, Navigation,* *and Geophysics* (1962). Articles: "Measurement of the Doppler Shift of Radio Transmissions from Satellites," *Proc. IRE* (1960); "Time Standard Requirements in Satellite Tracking for Navigation and Geophysics," *Nerem IRE Record* (1961); "Acquisition of Electronic Geodetic Satellite Data," *Trans. Am. Geophys. Union* (1967); "Tropospheric and Ionospheric Propagation Effects on Satellite Radio-Doppler Geodesy," *Proc. IAG Symp. on Electromagnetic Distance Measurement (1967).*

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J. A. WOOD, Geologist; Research Associate, Harvard University. 1954: B.S., Virginia Polytechnic Institute; 1958: Ph.D., Massachusetts Institute of Technology; 1959–1960: Postdoctoral Fellow, Petroleum Research Fund, American Chemical Society, Cambridge University; 1963–1965: Research Associate, Enrico Fermi Institute for Nuclear Studies, University of Chicago. Specialties: chemical analyses and mineralogical studies of meteoritic and lunar material. Current research on deduction of conditions and circumstances under which the terrestrial planets formed, by obtaining and studying samples of planetary matter that has not been changed or reworked since the time when the planets accreted, at present obtainable only from meteorites; studying the nature of planets in which meteorites evolved during the early epochs of the solar system. Book: *Meteorites and the Origin of Planets* (1968). Articles: "Metamorphism in Chondrites," *Geochim. Cosmochim. Acta* (1962); "On the Origin of Chondrules and Chondrites," *Icarus* (1963); "The Cooling Rates and Parent Planets of Several Iron Meteorites," *Icarus* (1964); "Chondrites: Their Metallic Minerals, Thermal Histories, and Parent Planets," *Icarus* (1967).

F. W. WRIGHT, Astronomer. 1919: B.A., Pembroke; 1920: M.A. Brown; 1927–1930: Radcliffe; 1937–1961: Harvard; 1958: Ph.D., Radcliffe; 1928–1942: Research Assistant, Harvard University; 1942–1946: Teaching Fellow, Harvard University; 1946–1963: Executive Secretary, Department of Astronomy, Harvard University; 1946–1961: Research Assistant, Harvard Meteor Project. Specialties: extraterrestrial particles and volcanic spherules; research on Large Magellanic Cloud–especially variable stars—to determine more accurately the extragalactic distance and scale and to establish the place of variable stars in the evolutionary pattern of stellar life. Has completed collaborative surface analyses, by the electron-beam microanalyzer technique, of dust particles that are possibly cosmic in origin; collaborated on an atlas of the Large Magellanic Cloud. Currently collaborating on analyses of the interiors, similar to the surface analyses, of spherules that had previously been subjected to surface analyses to substantiate conclusions about their origin; continuing investigations of volcanic spherules. Books: with P. W. Hodge, *The Large Magellanic Cloud* (1967); *Celestial Navigation* (1969). Articles: with P. W. Hodge, "Studies of Particles for Extraterrestrial Origin, 4. Microscopic Spherules from Recent Volcanic Eruptions," *Journ. Geophys. Res.* (1965); with P. W. Hodge, R. V. Allen, "Electron-Probe Analyses of Interiors of Microscopic Spheroids from Eruptions of the Mt. Aso, Surtsey, and Kilauea Iki Volcanoes," *SAO Special Rpt. 228* (1966); with P. W. Hodge, C. C. Langway, Jr., "Studies of Particles for Extraterrestrial Origin. 5. Compositions of the Interiors from Arctic and Antarctic Ice Deposits," *Journ. Geophys. Res.* (1967); with P. W. Hodge, "Studies of Particles for Extraterrestrial Origin. 6. Comparisons of Previous Influx Estimates and Present Satellite Flux Data," *Journ. Geophys. Res.* (1968); with P. W. Hodge, "Studies of the Large Magellanic Cloud. X. Photometry of Variable Stars," *Astrophys. Journ. Suppl.* (1969); with D. E. Brownlee, P. W. Hodge, "Upper Limits to the Micron and Submicron Particle Flux at Satellite Altitudes," *Journ. Geophys. Res.* (1969).

J. P. WRIGHT, Astrophysicist; Lecturer, Harvard University. 1956: B.S., Florida; 1961: Ph.D., Chicago; 1961–1963: NSF–NRC Associate, Institute for Space Studies; 1963–1964: Visiting Assistant Professor of Mathematics, Mathematics Research Center, University of Wisconsin. Speciality: the role of rotation in general relativity and problems of energy in general relativity. Collaborated in evaluation of the pulsation periods of relativistic objects, paying particular attention to neutron stars where the whole star may pulsate in 0.001 second; investigated the role of rotation in a particular relativistic model of the universe. Conducted a study of the implications of the 3°K blackbody radiation in cosmological models and high-energy astrophysics and the status of current tests of general relativity theory. Articles: "Pulsation Periods of General Relativitistic Objects," *Nature* (1965); with G. C. Fazio, F. W. Stecker, "Cosmic Blackbody Radiation, High-Energy Electrons, and the Origin of Isotropic X-ray and Gamma Radiation," *Astrophys. Journ.* (1966); with E. M. Gaposchkin, "A Measurable Effect of General Relativity in Satellite Orbits," *SAO Special Rpt. 283* (1968); with J. Silk, "The Gravitational Collapse of a Slowly Rotating Relativistic Star," *Monthly Notices Roy. Astron. Soc.* (1969); with E. M. Gaposchkin, "Measurable Effect of General Relativity in Satellite Orbits," *Nature* (1969).

DEPARTMENT OF MINERAL SCIENCES
NATIONAL MUSEUM OF NATURAL HISTORY

Collections

The Department of Mineral Sciences of the Museum of Natural History, comprising the Divisions of Meteorites, Mineralogy, and Petrology, possesses collections of minerals, rocks, meteorites, and tektites which are among the largest and most complete in the world. The rock collection is extensive and contains as one of its most important features a special collection of more than 2,000 analyzed rocks. The mineral collection, already very large and complete, has been greatly augmented by the recent acquisition of the Carl Bosch Collection of some 30,000 mineral specimens. This old German collection is rich in valuable research material from classical European localities. With its very large collection of 570 meteorites, the Bosch Collection also supplements what is already the world's largest meteorite collection. The ever-expanding collections in the Department thus constitute large reservoirs of source material for a great variety of research problems in mineralogy, petrology, and meteorites.

Research

Broad, long-range research now under way in the Department includes studies of the composition and origin of stony meteorites and lunar rocks; applications of X-ray microanalysis in meteorites; petrology of stony meteorites; textures and structures of meteorites; relations of stony-iron meteorites to other groups; chemical investigation of meteorites; experimental phase equilibria studies of minerals; studies of the garnet group; systematic mineralogy of major mineral groups; studies of rocks of the oceanic crust and upper mantle from the equatorial Atlantic; and equilibrium in metamorphic rocks.

Facilities

The Department operates modern and complete laboratories, including a chemical analytical laboratory, emission and X-ray fluorescence spectroscopy, electron microprobe and X-ray diffraction facilities, and modern optical microscopy, photographic and emission spectrographic equipment. A well-equipped shop for preparation of thin and polished sections provides supporting services to the scientific staff.

Cooperation with Other Institutions

The Department's relationships with many institutions, both here and abroad, are particularly close. Its work is furthered by governmental grants, such as the

National Aeronautics and Space Administration's grant for studies of meteorites and their bearing on theoretical problems and the Air Force's grant for a study of the chemical compositions of meteorites. Research is carried on in conjunction with such institutions as the Scripps Oceanographic Institution, Woods Hole Oceanographic Institution, the University of Pittsburgh, the Field Museum of Natural History, Corning Glass Works, and the U.S. Geological Survey. Meteorite studies are undertaken in cooperation with the Geological Survey of India, the Vienna Naturhistorisches Museum, the Max Planck Institute, the Paris Musee d'Histoire Naturelle, the UNESCO Group on Meteorites, the Swedish Karolinska Institut, and the University of Stockholm.

Research Staff

ROY S. CLARKE, Jr., Associate Curator, Division of Meteorites. 1949: B.A., Cornell; 1957: M.S., George Washington; 1949–1953: Chemist, U.S. Department of Agriculture; 1953–1957: Chemist, U.S. Geological Survey. Specialty: chemical analysis and composition of meteorites, and tektite studies; current research on chemical and mineralogical relationships in the metallic phases of the Campo del Cielo meteorites, and age studies of tektites, relationship between tektites and impactite. Articles: with J. F. Wosinski, R. Marvin, I. Friedman, "Potassium-Argon Ages of Artificial Tektite Glass," abstract *Trans. Amer. Geophys. Union* (1966); with John F. Wosinski, "Baddeleyite Inclusion in the Martha's Vineyard Tektite," *Geochim. et Cosmochin. Acta* (1967).

PAUL E. DESAUTELS, Associate Curator, Division of Mineralogy. 1942: B.S., Pennsylvania; 1948: M.S., Pennsylvania; 1949–1958: Professor of Chemistry, Towson College, Md. Specialty: general mineralogy and crystallography, with emphasis on descriptive mineralogy; current research on systematic mineralogy. Instrumentation and techniques: single crystal and powder diffraction X-ray techniques. Books: *Gems in the Smithsonian Institution* (1965); *Morphology of McKelvyite* (1967; *The Mineral Kingdom* (1969).

KURT A. I. FREDRIKSSON, Curator, Division of Meteorites; Research Associate, Scripps Institute of Oceanography, University of California, San Diego. 1946: Degree in Chem. Eng., Institute of Technology, Stockholm; 1947: Fil. lic., University of Stockholm; Research Associate, University of California, San Diego. 1948–1960: Geochemist, Geological Survey of Sweden; 1960–1964: Assistant Research Associate (Assistant Professor), University of California, San Diego. Specialties: chemical and mineralogical analysis of deep sea sediments, especially extraterrestrial debris; geochemical prospecting, including development of analytical methods and instrumentation and laboratory organization; analytical and experimental work on meteoritic material, in connection with development of special instrumentation and techniques for electron microprobe analysis. Current research on composition and origin of meteorite and lunar rocks; phase analysis with electron probe in meteorites and related mineralogical systems, natural and artificial, petrology of ignimbritic rocks and impactites. Techniques: electron microprobe techniques, especially mineral analysis. Articles: with K. Keil, "The Fe, Mg and Ca Distribution in Coexisting Olivines and Rhombic Pyroxenes of Chondrites," *J. of Geophysical Res.* (1964); with P. S. DeCarli, R. O. Pepin, G. Turner, J. H. Reynolds, "Shock Emplaced Argon in a Stony Meteorite," *J. of*

Geophysical Res. (1964); with A. M. Reid, "A Chondrule in the Chainpur Meteorite," *Science* (1965); with K. Boström, "Surface Conditions of the Orgueil Meteorite Parent Body as Indicated by Mineral Association," *Sm. Mis. Coll.* (1966); "Standards and Correction Procedures for Microprobe Analysis of Minerals," *Proc. IV Intl. Conf. on X-Ray Optics and Microanalysis, Paris, France* (1967); with Arch Reid, "Chondrules and Chondrites," *Researches in Geochemistry* (1967). Speaks Swedish, German.

ROBERT F. FUDALI, Geochemist, Division of Meteorites. 1956: B.A., Minnesota; 1960: Ph.D., Pennsylvania State; 1960–1962: Postdoctoral Research Associate, Pennsylvania State University; 1962–1966: Technical Staff, Bellcom Inc. Specialties: geochemistry, experimental petrology; current research on experimental phase equilibria studies bearing on the origin and evolution of igneous and metamorphic rocks and meteorites, shock metamorphism in rocks and minerals, study of ancient meteorite impact scars (astroblemes). Fieldwork: western Montana, Oregon, Northwest Africa. Articles: "Richat and Semsiyat Domes, Mauritania: Not Astroblemes," *Geological Soc. America Bul.* (1969); "Coesite from the Richat Dome, Mauritania: A Misidentification," *Science* (1969).

E. P. HENDERSON, Curator Emeritus, Division of Meteorites, 1924: B.S., George Washington; 1927: M.S., George Washington; 1963: Dr. Honoris Causa, Bern; 1919–1920: Geochemist, U.S. Geological Survey. Specialties: metallography of iron meteorites, descriptive studies of meteorites and minerals; current research on composition and origin of meteorites, particularly irons. Fieldwork: Australia, Alaska, Philippines, Prince Edward Islands. Article: "Hexahedrites," *Sm. Misc. Coll.* (1965).

EUGENE JAROSEWICH, Chemist, Division of Meteorites. 1957: B.S., Illinois; also graduate work, Northwestern and Minnesota; 1957–1962: Chemist, Sinclair Research, Inc.; 1962–1964: Chemist, Honeywell. Specialty: analytical chemistry; current research on chemical investigation of meteorites, minerals, and rocks. Instrumentation and techniques: classical chemical analysis, X-ray fluorescence, X-ray diffraction flame emission, atomic absorbtion. Article: "Chemical Analysis of Seven Stony Meteorites and One Silicate Rich Iron," *Geochim. Cosmochim. Acta* (1967); "Chemical Analyses with Notes on One Nesosiderite and Seven Chondrites," *Geochim. Cosmochim Acta* (1968). Speaks German, Ukrainian, Polish, Russian.

BRIAN H. MASON, Curator, Division of Meteorites. 1937: B.S., New Zealand; 1938: M.S., New Zealand; 1943: Ph.D., Stockholm; 1947–1953: Professor of Mineralogy, Indiana University; 1953–1965: Chairman, Department of Mineralogy, American Museum of Natural History. Specialties: geochemistry and cosmochemistry: meteorites and terrestrial rocks and minerals. Current research on mineralogy, petrology, and geochemistry of minerals. Fieldwork: southern Alps, New Zealand, Australia. Books: *Meteorites* (1962); 3d edition, *Principles of Geochemistry* (1966). Speaks Swedish, German, French.

WILLIAM G. MELSON, Associate Curator, Division of Petrology; Assistant Professor of Geochemistry and Petrology, George Washington University. 1961: B.A., Johns Hopkins; 1963: M.A., Princeton; Associate Professorial Lecturer. 1961: Geologist, U.S. Geological Survey; 1964: Research Associate, Princeton University. Specialty: igneous and metamorphic petrology; current research on rocks for the Mid-Atlantic Ridge; studies of active volcanoes. Fieldwork: northern Rocky Mountains (western Montana), Mid-Atlantic Ridge, Arenal Volcano, Costa Rica. Articles: "Phase Equilibria in Calc-Silicate Hornfels," *Am. Mineralogist* (1966); "Metamorphism in the Mid-Atlantic Ridge, 22° N. Latitude," *Marine Geol.* (1966); "St. Peter and St. Paul Rocks; High Temperature Mantle Derived Intrusion," *Science* (1967).

GEORGE SWITZER, Curator. 1937: B.A., California; 1942: Ph.D., Harvard; 1940–1945: Instructor in Mineralogy, Yale University; 1946–1947; Crystallographer, U.S. Geological Survey. Specialties: crystallography, systematic mineralogy; paragenesis of minerals; current research on garnet group of minerals, petrology of xenoliths in Kimberlite pipes. Articles: "The Bavenite Problem," *Amer. Mineral.* (1953); "Ordonezite, Zinc Antimonate, a New Mineral from Guanajuato, Mexico," *Amer. Mineral.* (1955); "Galeite and Related Phases in the System Na_2SO_4–NaF–NaCl," *Amer. Mineral.* (1963); "Fluorine in Hambergite," *Amer. Mineral.* (1965); "Plagioclase-Spiner-Graphite Xenoliths in Metallic Iron-Bearing Basalts, Disko Island, Greenland," *Amer. Mineral.* (1966); "Partially melted Kyonite eclogite from the Roberts Victor Mine," *South Africa* (1969).

ADDITIONAL SMITHSONIAN STAFF MEMBERS WITH INTERESTS RELATED TO PHYSICAL SCIENCE

JACK PIERCE, Associate Curator, Division of Sedimentology; Specialty: coastal and shallow water sedimentation and processes; Full listing under "Program in Evolutionary and Systematic Biology."

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ALPHABETICAL INDEX OF SMITHSONIAN STAFF

ADEY, Walter H. 138
ADROSKO, Rita J. 11, 48
AHLBORN, Richard E. 39
ALBRIGHT, Alan B. 72
ALDRICH, John W. 149, 185
ALEXANDER, Carl A. 75
ALLISON, A. C. 201
ANDERSON, G. F. 202
ANGEL, J. Lawrence 97
ANGLIM, John E. 75
ARCHER, W. Andrew 111
ARON, William I. 180
AVRETT, E. H. 202
AYENSU, Edward S. 111
BANKS, Richard C. 149
BARNARD, J. L. 129
BATTISON, Edwin A. 11
BECKLIN, E. E. 202
BEDINI, Silvio A. 12, 39
BEER, Alice Baldwin 48, 59
BEHLEN, Eugene F. 75
BENSON, Richard H. 139
BINGHAM, Lois 56
BISHOP, Philip W. 12, 48
BLAKER, Margaret C. 97
BLITZER, Charles x
BOARDMAN, Richard S. 139
BOORSTIN, Daniel J. 12, 39
BOWMAN, Doris M. 72
BOWMAN, Thomas E. 129
BRADLEY, James Christopher, Jr. ix
BREESKIN, Adelyn Dohme 48, 56
BREWER, Dorothy Z. 48
BRIDGWATER, Donald D. 175
BUECHNER, Helmut K. 164
BUZAS, Martin A. 139
CALLAND, Robert M. 23, 48
CANET, Isabel C. 130
CANNON, Walter F. 12
CARLETON, N. P. 202
CARTWRIGHT, Oscar L. 121
CASEY, Louis S. 20
CHACE, Fenner A., Jr. 130
CHALLINOR, David xi
CHAPELLE, Howard I. 13, 48
CHASE, W. T., III 62
CHEETHAM, Alan H. 140
CIFELLI, Richard 140
CLAIN-STEFANELLI, Elvira Eliza 13, 39
CLAIN-STEFANELLI, Vladimir 13, 40
CLARK, J. F. Gates 121
CLARKE, Roy S., Jr. 223
COGSWELL, Margaret 56
COHEN, Daniel M. 149
COLLETTE, Bruce B. 149
COLLINS, Herbert R. 40
COLLINS, Larry R. 175
COLOMBO, G. 203
CONGER, Paul S. 112
COOPER, G. Arthur 141
COOPER, Grace Rogers 14, 41
CORRELL, David L. 168
COWAN, Richard S. 107
CRABILL, Ralph E., Jr. 122
CREIGHTON, Reginald A. 82
CRESSEY, Roger F. 130
CROCKER, William H. 97
CROCKETT, James J. 82
CUATRECASAS, Jose 112
DALGARNO, A. 203
DAMKAER, David M. 183
DAVIS, Audrey B. 14
DAVIS, Donald R. 122
DAVIS, R. J. 203
DAVIS, Robert Tyler 56
DEARBORN, Mona L. 47
DEE, Elaine Anne Evans 48, 59
DESAUTELS, Paul E. 223
DEUTSCHMAN, W. A. 204
DICKEY, J. S., Jr. 204
DICKINSON, D. F. 204
DILLON, Wilton S. xii, 98
DIXON, Nathaniel R. xii
DRESSLER, Robert L. 191
DUCKWORTH, W. Donald 122
DURANT, Frederick C., III 20
EISENBERG, John F. 175
EKLUND, Jon B. 14
ELLIOTT, John M. 26, 48, 72
ERNST, Wallace Roy 112
EVANS, Clifford 98
EWERS, John C. 26, 49, 64, 98
EYDE, Richard Husted 113
FABIAN, Monroe H. 47
FAZIO, C. G. 204
FEHLMANN, H. A. 182
FESPERMAN, John T. 41, 64
FIELD, William D. 122
FINN, Bernard S. 14, 49
FIREMAN, E. L. 205
FLANNERY, M. R. 205
FLINT, Oliver S., Jr. 123
FORTI, G. 205
FOSBERG, F. Raymond 113, 185, 194
FOSTER, Willis R. 87
FRANKLIN, F. A. 206

FREDRIKSSON, Kurt A. I. 223
FREEMAN, Monroe E. 87
FRIEDMAN, M. P. 206
FROESCHNER, Richard C. 123
FUDALI, Robert F. 224
GALLER, Sidney R. x, 169
GANTT, Elizabeth 169
GAPOSCHKIN, E. M. 206
GARBER, Paul E. 20
GARDNER, Paul V. 14, 41
GAZIN, C. Lewis 141
GETTENS, Rutherford J. 62
GIBBS, Robert H., Jr. 150
GIBSON, Gordon D. 99
GINGERICH, O. J. 26, 207
GLYNN, Peter W. 192
GOINS, Craddock R., Jr. 27, 41
GOLOVIN, Anne Castrodale 41
GOODWIN, Jack 78
GRAY, Clinton W. 176
GROSCH, H. R. J. 82
GROSSI, M. D. 207
HABERSTICH, David E. 49, 64, 72
HALE, Mason E., Jr. 113
HAMARNEH, Sami K. 15
HAMID, S. E. 207
HANDLEY, Charles O., Jr. 150, 185
HARREN, Shirley S. 49, 72
HARRIS, Elizabeth M. 15
HELMKEN, H. F. 208
HENDERSON, E. P. 224
HERSEY, David F. 87
HICKEY, Leo J. 141
HOBBINS, James M. 24
HOBBS, Horton H., Jr. 131
HODGE, P. W. 208
HOFFMAN, John N. 15, 49
HOGENSON, Aleita A. 47
HOOVER, Cynthia A. 41, 64
HOPE, W. Duane 131
HORSLEY, Jaren G. 176
HOTTON, Nicholas, III 141
HOWELL, Edgar M. 27, 42
HOWLAND, Richard H. 32
HUBBARD, John Patrick 151
HUEBER, Francis M. 142
HUFFER, Mary A. 78
HULINGS, Neil C. 183
HUNT, Bernard 88
HUNTER, Robert 57
HUTCHINS, James S. 23, 49
JACCHIA, L. G. 208
JACKSON, M. H. 15, 49
JAFFEE, Cynthia J. 63
JAROSEWICH, Eugene 224
JONES, Meredith L. 132, 185
KAINEN, Jacob 57
KALKOFEN, W. 209
KAUFFMAN, Erle G. 142
KENK, Roman 132
KIDWELL, Claudia B. 42
KIER, Porter M. 143
KLAPTHOR, Margaret B. 42
KLEIN, William H. 168
KLOSTER, Donald E. 72
KNAPP, Leslie W. 183
KNEZ, Eugene I. 99
KORNICKER, Louis S. 132
KOVY, Stanley A. 83
KOZAI, Y. 209
KRESYA, Frank J. 88
KROMBEIN, Karl V. 124
LACHNER, Ernest A. 151, 185
LAMBECK, K. 210
LANDRUM, Betty J. 184
LANGLEY, Harold D. 27, 42
LAUGHLIN, Robert M. 99
LAWLESS, Benjamin 75
LAWTON, Thomas 62
LAYBOURNE, Roxie C. 151
LECAR, M. 210
LEHR, C. G. 210
LEIGH, Egbert G., Jr. 192
LELLINGER, David B. 113, 194
LERNER, Abram 63
LEVINE, M. W. 210
LEVY, H., II 210
LILLEY, A. E. 211
LOWE, Harry 57
LUNDEBERG, Philip K. 27, 43
LUNDQUIST, C. A. 201
MA, Te-Hsiu 170
MAGRUDER, John H., III 23, 49
MAHONEY, James A. 75
MANNING, Raymond B. 133
MANVILLE, Richard H. 152, 185
MARGULIES, Maurice M. 170
MARSDEN, B. G. 211
MARVIN, U. B. 211
MASON, Brian H. 224
MATHUR, N. C. 212
McCAIN, John C. 184
McCELLAND, Donald R., Jr. 57
McCLURE, Floyd A. 114, 194
McCROSKY, R. E. 212
MEGRUE, G. H. 212
MELDER, Keith E. 43
MELSON, William G. 224
MENEZ, Ernani G. 184
MENZEL, D. H. 213
MERTZ, L. 213
MERZBACH, Uta C. 16

MEYER, Robert B., Jr. 21
MILLER, J. Jefferson, II 16, 43, 64
MINAMI, Warren N. 83
MITLER, H. E. 213
MOHR, P. A. 214
MORRISON, Joseph P. E. 133
MORTON, Conrad V. 114
MOYNIHAN, Martin H. 191
MULLER, Kerry A. 176
MULTHAUF, Robert P. 16, 44
MURRAY, Anne W. 44
NAPIER, J. R. 152, 185
NICOLSON, Dan H. 114
NORBY, Reidar 16, 44
NOYES, R. W. 214
NOZAWA, Y. 214
ODELL, J. Scott 64, 73
OLIN, Charles H. 47, 73
OLIN, Jacqueline S. 64, 75
ORGAN, Robert 75
OSTROFF, Eugene 17, 44, 64
PAPALIOLIOS, C. 214
PARADISO, John L. 152
PARKER, Kittie Fenley 114
PAWSON, David L. 134
PAYNE-GAPOSHKIN, C. H. 215
PEARLMAN, M. R. 215
PETERS, James A. 153, 185
PETERSON, Mendel L. 27, 45
PETTIBONE, Marian H. 134
PIACESI, Dante, Jr. 83
PIERCE, Jack 143, 225
PIERSON, Stuart 25
PINE, Ronald H. 153
POLLACK, J. B. 215
POPE, John A. 62
POWELL, B. N. 215
RAND, A. Stanley 192
RAY, Clayton E. 144
READ, Benjamin H. xvi
REED, Theodore H. 175
REHDER, Harald A. 135
REINGOLD, Nathan 24
RICE, Mary E. 135
RIEKE, G. H. 215
RIESENBERG, Saul H. 97
RIPLEY, S. Dillon ix, 153, 186
RITTERBUSH, Philip C. xi
ROBINSON, Harold 115
ROBINSON, Michael H. 193
ROBISCHON, Ernest W. 21
ROHLFING, Christian 49, 60
ROPER, Clyde F. E. 135
ROSEWATER, Joseph 136
ROTH, Rodris 45
RUBINOFF, Ira 193
RUDD, Velva E. 115
RUETZLER, Klaus 136, 186
RYBICKI, G. B. 216
SADIK, Marvin S. 47
ST. HOYME, Lucile E. 99
SALISBURY, W. W. 216
SAUER, Robert M. 177
SCHAFFNER, M. R. 216
SCHEELE, Carl H. 17, 45
SCHILD, R. E. 217
SCHLEBECKER, John T. 17
SCHMITT, Waldo LaSalle 136
SCHULTZ, Leonard P. 154
SEHNAL, L. 217
SEKANINA, Z. 217
SETZER, Henry W. 154
SHANK, Russell 78
SHAPIRO, Frances R. 64
SHETLER, Stanwyn G. 115, 186
SHROPSHIRE, Walter, Jr. 171
SIMKIN, Thomas E. 184
SKRAMSTAD, Harold K. 32
SLUD, Paul 154, 186, 194
SMITH, Jean Chandler 78
SMITH, Lyman B. 115
SMITH, Neal Griffith 194
SNYDERMAN, Martin 88
SODERSTROM, Thomas R. 116
SONDAY, Milton Franklin, Jr. 49, 59
SOUTHWORTH, R. B. 217
SPANGLER, Paul J. 124
SPRINGER, Stewart 154
SPRINGER, Victor G. 155
STAGE, Gerald I. 125
STANLEY, Daniel J. 144, 225
STANLEY, Sam 100
STEPHENSON, Genevieve A. 49, 73
STERN, Harold P. 62
STEWART, Robert G. 48, 71
STEWART, T. Dale 100
STOKESBERRY, James J. 23, 49
STROM, S. E. 218
STUCKENRATH, Robert, Jr. 171
STURTEVANT, William C. 27, 64, 100
SUSZYNSKI, Nicholas J., Jr. 81
SWITZER, George 225
TALBOT, Lee M. 164
TAX, Sol x
TAYLOR, Frank A. xi, 74
TAYLOR, Lisa Suter 58
TAYLOR, William R. 155
TOWE, Kenneth M. 145
TRAUB, W. A. 218
TROUSDALE, William B. 100
TRUETTNER, W. H. 50, 57
TSURUTA, S. 218

VAN BEEK, Gus W. 101
VEIS, G. 218
VESSOT, R. F. C. 219
VOGEL, Robert M. 17, 50
VOORHIS, Paul H. 101
WALKER, Egebert H. 116
WALKER, William 79
WALLEN, I. Eugene 163, 179
WALLER, Thomas R. 145
WARNER, William W. x
WASHBURN, Wilcomb E. 32
WATKINS, C. Malcolm 45, 64
WATSON, George E. 155, 186
WEAVER, James M. 47, 64
WEDEL, Waldo R. 101
WEEKES, T. C. 219
WEIFFENBACH, G. C. 219
WEINTRAUB, Robert L. 172
WEITZMAN, Stanley H. 156
WELSH, Peter C. 50, 64, 76
WHEELER, Towson Ames x
WHIPPLE, F. L. 200
WHITE, John Hoxland, Jr. 18, 50
WHITNEY, C. A. 220
WILLIAMSON, Francis S. L. 165
WOOD, J. A. 220
WOOD, Peter H. xii
WRIGHT, F. W. 220
WRIGHT, J. P. 221
WUNDER, Richard P. 58
WURDACK, John J. 116
ZUG, George R. 156
ZUSI, Richard L. 157

U.S. GOVERNMENT PRINTING OFFICE : 1969 O—367-637